United States Department of Agriculture

Prescribed Fire Management

Environmental Assessment

Francis Marion Ranger District, Francis Marion National Forest
Berkeley and Charleston Counties, SC

Forest Service
Francis Marion Ranger District, Francis Marion National Forest **January 2020**

Contents

Introduction

We are proposing to apply prescribed fire on the Francis Marion Ranger District of the Francis Marion National Forest (Francis Marion). National forest lands which may be acquired in the future and forest lands under other ownership covered in an appropriate agreement, may also be included.

We prepared this environmental assessment (EA) to determine whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI). Additional information on prescribed fire management project is posted on-line at: https://www.fs.usda.gov/project/?project=53945.

Prescribed fire activities described in this EA are consistent with the 2017 *Final Revised Land Management Plan* (Forest Plan) and are designed to specifically address direction on managing fire-adapted ecosystems and fuels within the wildland-urban interface. The 2017 Forest Plan and associated Final Environmental Impact Statement (FEIS) are located on-line at https://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=FSEPRD575346.

Project Location

The Francis Marion National Forest is located on the coastal plain of South Carolina and contains approximately 262,000 acres in Berkeley and Charleston Counties and is near the metropolitan area of Charleston. The Santee Experimental Forest constitutes approximately 6,000 acres of the 262,000 acres and is located within the administrative boundary of the Francis Marion National Forest. Acquired national forest lands and other ownerships that might be prescribed burned would be within the administrative boundary of the Francis Marion National Forest. See Figure 1 for a project vicinity map.

Need for the Proposal

The Francis Marion currently has an active prescribed burning program. This current program, however, does not include prescribed burning many outlying areas (approximately 103,000 acres) that are near communities such as Macedonia, Bethera, along the US Highway 17 corridor, Awendaw, etc. See Figure 2. We refer to these areas as Wildland Urban Interface (WUI) areas or "communities at risk" of potential wildfires. As communities have grown and populations have increased, more people and structures are located within close proximity to the Francis Marion National Forest. There is a need to protect these communities from the risk of potential catastrophic wildfires from occurring. In order to protect these areas, we need to implement prescribed burns to reduce the vegetation surrounding these communities.

The consequences of not implementing our proposed action would be that we could not reduce the fuel loading or vegetation around many of these communities at risk in a controlled manner. The risk of catastrophic wildfires to these areas and communities would continue to greatly increase over time, such as continue buildup of pine needles, downed trees, etc. This could result in catastrophic wildfires to these communities, such as what occurred near Myrtle Beach in 2009, the Highway 31 fire. This catastrophic fire burned approximately 19,000 acres and destroyed 76 homes.

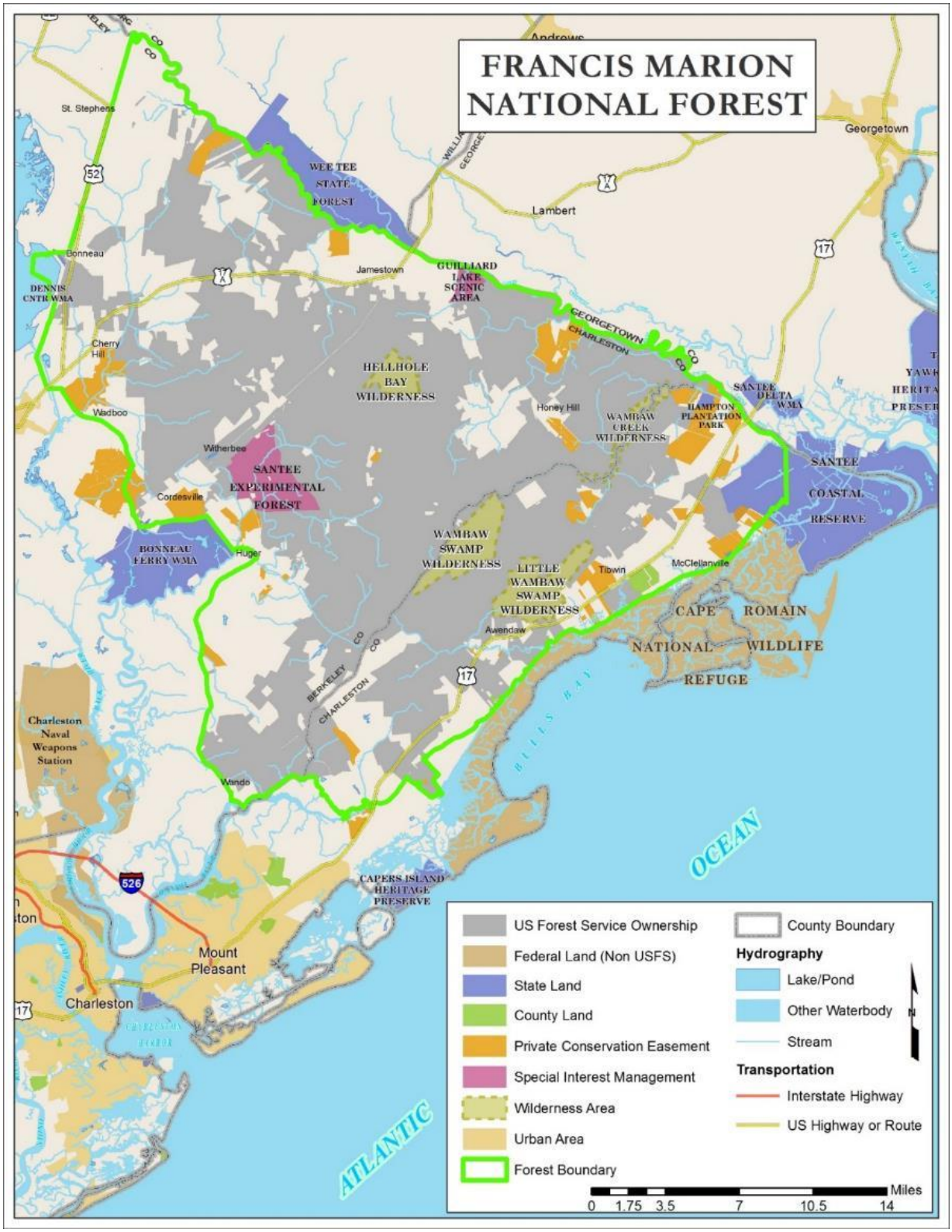


Figure 1. Vicinity map of the Francis Marion National Forest

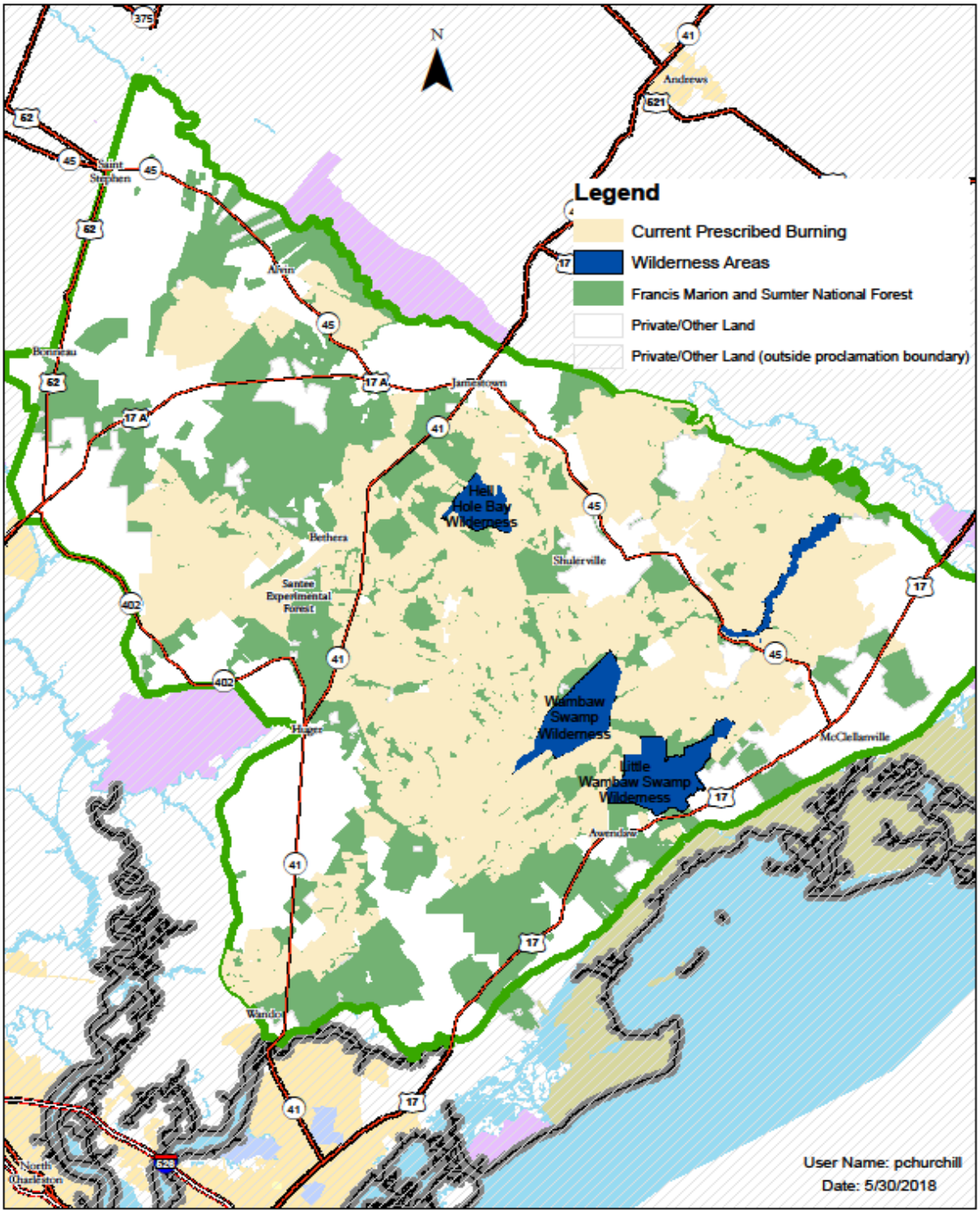


Figure 2. Current Prescribed Burning on the Francis Marion National Forest

Prescribed fire plays an important role ecologically as well. The primary reasons prescribed burning is used as a management tool in the project area are to:

- Reduce the risk of catastrophic wildfire to communities at risk
- Minimize the risk to the public from the impact of smoke from burning operations for forestry, ecological, and wildlife purposes.
- Create, enhance and maintain wildlife habitat (ex-white tail deer, endangered species, quail, wild turkey, plants)
- Sustain a diversity of ecosystems (ex-upland longleaf and loblolly pine, wet pine savannahs and flatwoods, etc.)
- Complete site preparation for tree planting and timber sales preparation

Existing Condition vs Desired Condition

In 2006, the Francis Marion completed an environmental assessment and decision to prescribed burn, which directed prescribed fire operations. The 2006 decision included landscape-level prescribed burning on a two to five-year rotation over 121,832 acres. A maximum of 60,000 acres would be burned during the growing season (April to October) over a 5-year period. Between 2005 and 2012, 19,597 acres (36%) of potential and existing upland longleaf woodlands and 27,138 acres (15%) of the wet pine savanna and flatwoods ecosystem within the Francis Marion were burned three or more times (2.6 year burning rotation). Most the prescribed burning efforts have focused on prescribed burning the central portion of the Francis Marion, which eventually became Management Area 1 in the 2017 Forest Plan. The 2006 decision focused on maintaining and restoring upland longleaf (*Pine palustris*) and loblolly pine (*Pinus taeda*) forest and providing habitat for fire-adapted plants and animals. See Figure 2 for a map of the area currently prescribed burned.

In the 2006 decision, prescribed burning may occur on up to 5,500 acres within the four Wildernesses: Hellhole Bay, Wambaw Swamp, Little Wambaw Swamp and Wambaw Creek.. The use of prescribed fire reduces the risk of damaging wildfire which could spread into adjacent areas. Prescribe fire would be ignited manually or allowed to back into wilderness from adjacent uplands on up to 3,000-5,000 acres. Up to 300-500 acres occurring within Wambaw Swamp Wilderness, Compartments 173 and 186 would be ignited directly by helicopter with Regional Forester permission. Prescribed fire in wilderness is authorized in a letter to the Francis Marion from the Regional Forester dated June 22, 2006.

The Forest Plan for the Francis Marion was signed in March 2017. The 2017 Francis Marion Forest Plan established management direction for two management areas across the national forest. The primary difference between the two management areas is the ability to safely apply landscape-level, frequent prescribed fire. Management Area 1 (MA1) was developed from the current area prescribed burned on the Francis Marion and also provided the best opportunities for maintaining and restoring sustainable levels of fire-adapted longleaf ecosystems and habitats for fire-adapted at-risk species. While Management Area 2 (MA2) focused on reducing fuel loadings within the wildland urban interface. See Table 1 and Figure 3. Based on the difference in the 2017 Forest Plan direction and the prescribed fire activities covered in the 2006 decision, some needs to address fire management were identified:

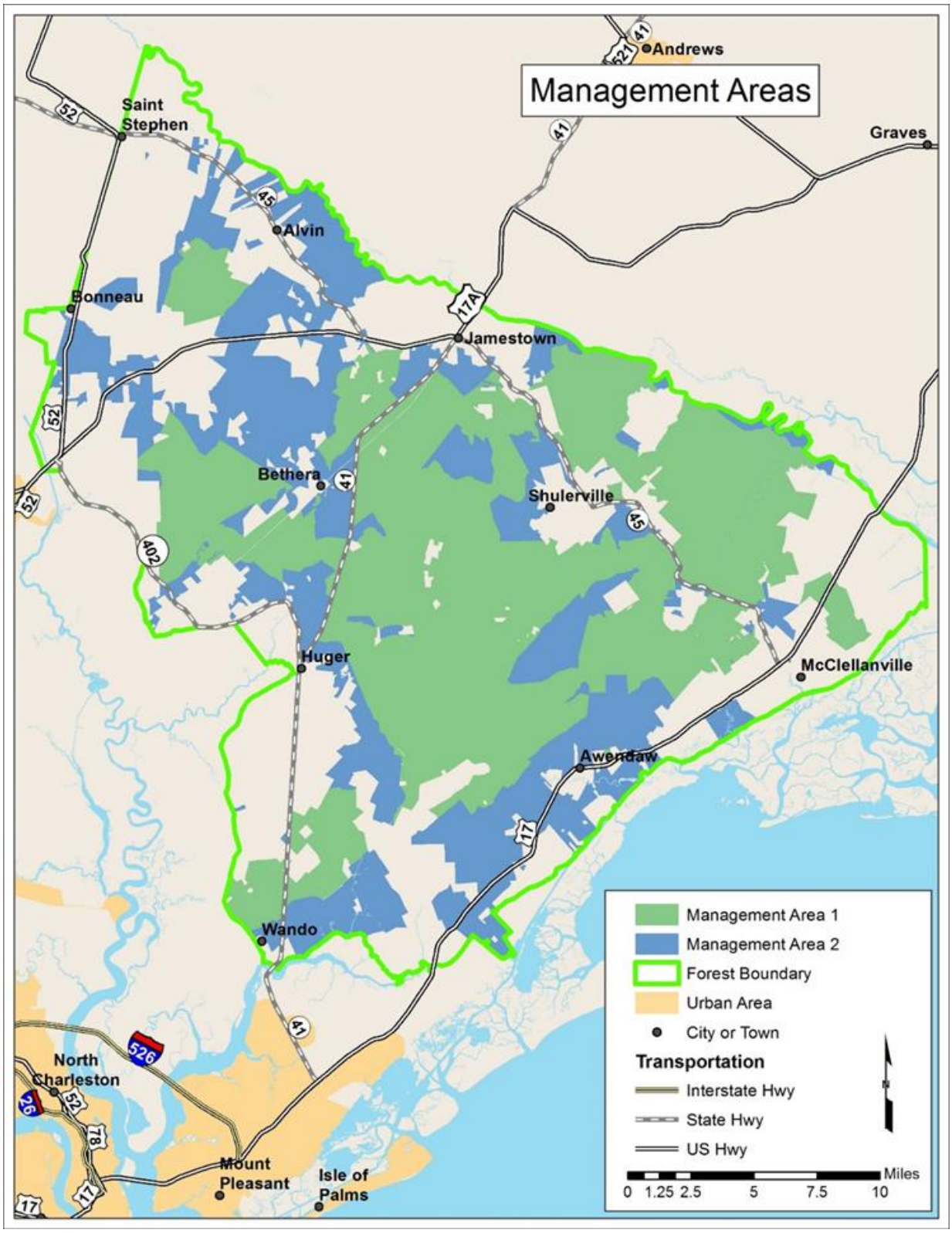


Figure 3. Management Area 1 and Management Area 2

Table 1. Management Area 1 and forestwide acreages for each ecosystem

Potential Ecosystem on Francis Marion	MA1 (acres)	Forestwide (acres)
Upland Longleaf Pine Woodlands and Forests	33,400	52,000
Wet Pine Savannas and Flatwoods	58,100	86,200
Depressional Wetlands and Carolina Bays	6,400	8,800
Pocosins	7,200	9,100
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	26,100	44,200
Oak Forests and Mesic Hardwood Forests	1,900	5,800
Maritime Forests and Salt Marsh	50	4,000
Broad Forested Swamps and Large River Floodplain Forests	23,000	49,200
Grand Total	156,150	259,300

- **Within MA1**, prescribed fire management has focused on the maintenance and restoration of longleaf pine within the core of the Francis Marion. See Figure 2. Loblolly pine is currently the most abundant tree species on the Francis Marion National Forest occupying over 104,376 acres (includes mixtures with non-mast producing hardwoods), and much of this occurs as forests (>60% canopy cover). The majority of our loblolly pine forests occur on longleaf pine ecosystem sites, including approximately 25,673 acres on upland longleaf sites and approximately 50,760 acres on wet pine savanna sites (2013, Forest Plan Assessment, Sec.1-Ecosystems). Between 2005 and 2012, approximately 19,597 acres (36%) of potential and existing upland longleaf woodlands and approximately 27,138 acres (15%) of the wet pine savanna and flatwoods ecosystem were burned three or more times (2.6 year burning rotation). The total acres prescribed burned on the forest have remained fairly constant, but have not met the long-term objectives for total burning and growing season burning within longleaf pine forest types.

  Strategic priorities and actions in America's Longleaf ((http://www.americaslongleaf.org) were incorporated in the 2017 Forest Plan and include improving and maintaining the condition of longleaf pine ecosystems by increasing the acreage of prescribed fire and fire frequency (every 2-2 ½ years) which supports a majority of ecological and species needs on the Francis Marion. Specifically, the 2017 Forest Plan includes an objective to prescribed burn an average of 30,000 to 50,000 acres annually within Management Area 1 (MA1) as needed to maintain and restore the estimated 91,500 acres of longleaf ecosystems on an average 2-year rotation. Approximately 33% of these prescribed burns are in the growing season. Desired fire return intervals were identified in the Forest Plan and listed in Table 5.

- **Within MA2** (103,000 acres)**, t**he Francis Marion National Forest occurs adjacent to a large and rapidly expanding urban interface, driven by swiftly expanding population growth and urbanization. The August 2001 Federal Register lists 12 communities within the Francis Marion National Forest proclamation boundary (Germantown, Tibwin, McClellanville, Awendaw, Wando, Honey Hill, Shulerville, Huger, Cordesville, Bethera, Jamestown, and St. Stephen), that occur in the wildland-urban interface and are "at risk" from wildfire. Within the Francis Marion National Forest boundary, approximately 38% of the land is privately owned, further contributing to fuel management challenges and the risk of wildfire.

To meet 2017 Forest Plan direction for MA2, the management of fuel loadings within the wildland urban interface should be considered. Prescribe fire is one of the management tools used to address fuel loadings. While this environmental assessment only addresses prescribed fire, other options, such as timber sales may be used to address fuel loadings within MA2. Direction in MA2 focuses on fuel reduction moving the fire regime condition classes (FRCC) 2 and 3 toward more natural fire return intervals. Specifically, **OBJ-MA2-1 Hazardous Fuels** includes: *Maintain or provide for low to moderate fuel loads (Fire Regime Class 2 or better) on approximately 15,000 acres within 10 years of plan approval in Management Area 2*. The objective also states to prioritize treatments to protect cities and towns with highest density of human communities and adjacent landowners. The prescribed fire management project considers how to best use prescribed fire in MA2 to address this need.

- **Within the Santee Experimental Forest,** the Francis Marion has historically burned 3,180 acres within the Santee Experimental Forest to restore longleaf pine on upland sites. Prescribed burning has taken place on the upland pine forests in three different locations within MA1 ranging in size from 170 acres to 836 acres. Coordination with the forest research team leader is necessary before burning takes place due to analysis requirements and the continuing monitoring of the forest stands.

  In the 2017 Francis Marion Forest Plan, desired condition **DC-RIZ- Santee-S-1. Santee Experimental Forest** states "*Areas within the Santee Experimental Forest that are not allocated to specific studies are managed based on potential ecosystems restoration including fire-maintained ecosystems when possible."* To meet Forest Plan direction on coordinated efforts with the Santee Experimental Forest, fire management on 5,920 acres within the Experimental Forest would be considered. The team leader for the Santee Experimental Forest would prioritize locations and time frames of prescribed burns in research areas. All monitoring will continue to be performed by the research team leader.

Table 2. Potential Ecosystems on the Santee Experimental Forest

Potential Ecosystems on Santee Experimental Forest	Management Area 1 (acres)	Forestwide (acres
Upland Longleaf Pine Woodlands and Forests	1,735	3,180
Mesic Hardwood Forests		2,740
Subtotal		5,920
Administrative and Study Areas		133
Grand Total		6,053

- Based on minimum requirements analyses completed for the four Wildernesses, there is an administrative need to address unnatural fuel loadings where they occur. Wambaw Creek is located within MA1 and the other three Wildernesses are located within MA2. Alternatives to address fire management within the four Wildernesses on the best way to maintain and preserve wilderness character and address fuel loading are considered. A draft fire management plan has been developed that addresses the management of prescribed fires and wildfires.

Proposed Action and Alternatives

Additional information on prescribed fire management project is posted on-line at: https://www.fs.usda.gov/project/?project=53945. In all alternatives, prescribed burning on the Francis Marion National Forest is conducted at a landscape scale, to not only mimic the natural spread of fire, but also to minimize the construction of dozer fireline, and the disking/blading of existing firelines. Existing roads and other natural topographic features (streams and water bodies) would, when possible, be used as control lines. Firelines would be blocked or smoothed as needed after burning to prevent further use. Agreements may be made with adjacent forest landowners in the future, further reducing the fuel hazards and firelines needed and improving habitats and forest health.

In all alternatives, progress toward meeting Forest Plan direction is reported in biennial monitoring reports posted on-line at https://www.fs.usda.gov/main/scnfs/landmanagement/planning. Depending on the findings from monitoring, forest personnel may need to adjust the forest plan direction, update the monitoring program or modify management actions.

All alternatives include prescribed burn an estimated 23,600 acres of private, state, county or other federal lands covered in appropriate cooperative agreements.1. It is anticipated that these areas can be burned as the Francis Marion staff complete its annual prescribed fire program of work. See Table 3.

Table 3. Estimated acres of prescribed burning on private, state, county and other federal lands through Wyden Agreements

Type	Acres
Existing	5,341
Potential	533
Potential New	17,640
Grand Total	**23,514**

Adaptive Approach for All Alternatives

An adaptive approach will be used, consistent with Forest Service policy for prescribed fire management, in conjunction with other district or forest decisions and with recently revised NEPA procedures (36 CFR, Part 220, July 24, 2008 and FSH 1909.15, chapter 10, section 14.1). The adaptive approach will use an "implement-monitor-adapt" strategy that provides flexibility to account for changes in environmental conditions or to respond to subsequent monitoring information that indicates that desired conditions are not being met. As part of an adaptive management approach, selected prescribed fire treatments will be monitored, evaluated and modified as necessary to improve effectiveness of future treatments while reducing the potential for adverse effects to people and natural resources. It may several years to achieve to desired conditions on the composition, structure, and function of ecosystems in the Forest Plan. Progress toward meeting the desired conditions in the Forest Plan are reported in the biennial monitoring

[1] The Wyden Amendment (Public Law 105-277, Section 323 as amended by Public Law 109-54, Section 434) authorizes the Forest Service to enter into cooperative agreements with willing participants for the protection, restoration, and enhancement of fish and wildlife habitat and other resources on public or private land within shared watersheds.

reports posted on-line at
https://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=STELPRDB5261459.

The adaptive approach allows for adopting findings different practices based on research, more effective methods, monitoring or changes in land or resource conditions. The adaptive approach is key to addressing changed conditions that are not currently identified and provides the flexibility to use the best method of treatment based on the results of monitoring and evaluation. The decision will be reviewed as new information is identified, new methodologies become available, or conditions change (storm events, wildfire, etc) which could modify the anticipated effects of the decision. Newly-acquired national forest may be prescribed burned as long as prescribed burning is consistent with this decision and Forest Plan direction (Standard S56). As new information becomes available, the environmental analysis and decision are supplemented or revised following the requirements in FSH 1909.15 Chapter 18.

Consistency with the Decision

The burn plans would ensure that planned prescribed fire treatment are consistent with the environmental assessment and decision document. Program managers and line officers review and verify that the planned objectives, treatments, design features and selected sites are within the scope and range of the decision notice. The development and review of burn plans would consider new information and monitoring results and determine if there is a need to correct, revise or supplement the analysis. Additional design features may be developed to address on-the-ground conditions.

In all alternatives, burn plans are required by agency policy and are guided by the direction in FS Manual 5140. The burn plans are approved by the district ranger and contain treatment-specific requirements regarding fuels, topography, and weather conditions under which the burn can be ignited as well as required fire behavior to meet the desired conditions and control the burn. Some burn blocks have been developed and include the location of firelines that would need to be constructed to accomplish the prescribed burn. Some portions of Management Area 2 have not been prescribed burn in several years and burn blocks and burn plans still need to be developed. Prescribed burn plans would be prepared and approved by a qualified professional on all burn units prior to implementation of any burning activity. Burn plans include information on objectives and precautions for public safety. Burn plans are prepared and the burn is executed to meet the requirements in the Smoke Management Guidelines (Appendix C).

Alternative 1 (Proposed Action)

The Francis Marion Prescribed Fire Management strategy strives to implement the 2017 Revised Forest Plan. The proposed strategy action includes prescribed burning approximately 262,000 acres of national forest system land (which includes the Santee Experimental Forest) using a rotation of burn blocks over a long-term basis. The rotation of burn blocks is dependent on weather, fuel moisture and a number of other factors. See Table B-1 in Appendix B for a detailed list of proposed acres by compartment and management area. See Figure 3 and map posted on-line for more information. Specifically, the strategy includes a rotation of burn blocks that would:

- **In MA1**, prescribed burn a range of 30,000 to 50,000 acres annually to maintain or restore fire-adapted ecosystems including longleaf pine and loblolly pine woodlands, savannas, and flatwoods, Carolina bays and depression ponds, and narrow river floodplains and swamps. This alternative includes prescribed burning 30,000 to 50,000 acres with approximately 10,500 to 16,500 acres (or approximately 33 percent) of growing season burns. Prescribed fire treatments should maintain habitats for at-risk

plants and animals and restore, maintain, and improve longleaf pine ecosystems using desired fire return intervals in Table 4.

Table 4. Desired fire return intervals for different ecosystems on the Francis Marion National Forest.

Potential Ecosystem [3]	Administrative Boundary (acres rounded to nearest hundred)	Historic Fire Return Interval (years)	Desired Fire Return Interval (Average number of years)[1]
Upland Longleaf Ecosystems and Loblolly Pine Woodlands	51,500	1-3	2
Wet Pine Savanna and Flatwoods	86,200	1-3	2
Depressional Wetlands and Carolina Bay	8,700	1-6	3
Pocosins	9,200	2-10	5
Oak Forests and Mesic Hardwood Forests	5,800	2-35	8
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	44,200	1-25	5
Broad Forested Swamps and Large River Floodplain Forests	49,200	1-218	21
Maritime Forests and Salt Marsh	4,000	2-52	10
Total	**259,300**	**n/a**	**n/a**

- **In MA2**, introduce prescribed fire in MA2 to facilitate meeting forest plan objective OBJ-MA2-1 which is to reduce fuel loadings near communities and roads on 15,000 acres within 10 years of plan approval. Based on the monitoring of effects and smoke management concerns, prescribed fire maybe increased to address Fire Regime Condition Class. While other treatments, such as timber harvesting or mastication maybe used to reduce fuel loading, this strategy focuses on the use of prescribed fire within MA2 and what is needed to use prescribed fire. Additional NEPA decisions would be completed as needed to address the use of mechanical treatments or herbicide applications. Prescribe fire treatments protect cities and towns (highest density of human communities) and adjacent landowners. The August 2001 Federal Register lists 13 communities at risk that are within the Francis Marion proclaimed boundary (Germantown, Tibwin, McClellanville, Awendaw, Wando, Honey Hill, Germantown, Shulerville, Huger, Cordesville, Bethera, Jamestown, and St Stephen).
- The Francis Marion has historically burned 3,180 acres within the Santee Experimental Forest to restore longleaf pine on upland sites. This proposal would consider fire management on approximately 6,000 acres within the Experimental Forest. The team leader for the Santee Experimental Forest will prioritize locations and time frames of prescribed burns in research areas. All monitoring will continue to be performed by the research team leader.
- Construction or maintenance of 314 miles of constructed firelines would be needed. See Table 5. This figure includes constructing new fireline in burn blocks in MA2 to manage the high fuel loadings near high risk areas near town and roads. See Appendix B for a list of existing and new firelines. In our proposal, we have tried to anticipate the firelines that will needed as burn blocks are developed in MA2. As the burn blocks are developed or modified for unforeseen circumstances and the need for additional firelines is identified, then either a supplement to the analysis or a categorical exclusion would be needed. Similarly as state and private properties are added as Wyden agreements then either a supplement to the analysis or a categorical exclusion would be needed to assess effects.

Forest plan standards, guidelines and project specific design criteria are designed to limit the impacts of fireline construction.

Table 5. Estimated mileage of constructed firelines by type

Type	Miles	Comments
2006 EA	17.2	Existing firelines are in Management Area 1 in areas that have been prescribed burned on a reoccurring basis. Burn blocks have been established with specific objectives.
Existing	136.9	Existing firelines are in Management Area 1 in areas that have been prescribed burned on a reoccurring basis. Burn blocks have been established with specific objectives.
New	134.8	New mileage is needed in Management Area 2 or newly acquired national forest lands. Many of these areas have not been burned since 1989 (since Hurricane Hugo) and new firelines are needed to introduce fire back into these areas. Specific burn blocks with objectives need to be developed.
Potential Wyden	24.8	These miles of fireline are needed to prescribed burn private, state, county or other federal lands. Wyden Agreements help reduce the total amount of constructed firelines.
Grand Total	**313.7**	

- Another connected action is to develop a feedback and reporting loop with the public. Management Areas 1 and 2 in the 2017 *Final Revised Land Management Plan* (Forest Plan) would be used to develop and prioritize burn blocks for prescribed fire activities. Monitoring would be used to refine the list of priority burn blocks. About 80,000 acres of priority burn blocks would be identified but only a subset of 30,000 to 50,000 acres would be prescribed burned due weather conditions, fuel loadings and other factors. This feedback loops allows Francis Marion staff to address public concerns ahead of any prescribed burns.
- The management of prescribed fire and wildfire in the four wilderness areas on the Francis Marion is considered. Prescribed fire would be allowed to spread into wilderness areas and lightning strikes in wilderness areas would be allowed to burn as long as human health and safety could be protected. We feel that this approach mimics the natural role of fire while reducing fuel loadings and preserving wilderness character.

Alternative 2 (Current Management)

In addition to the proposed action, the Forest Service also evaluated continuing to implement the fire program developed in the 2006 Prescribed Fire on the Francis Marion National Forest, South Carolina decision. The Francis Marion would use landscape-level prescribed fire on a two to five-year rotation over 121,832 acres. See Table 6.

Approximately 150,000 to 250,000 acres would be burned over the next five years. Landscape level burning is conducted across substantial areas of the landscape, but burn blocks typically vary from two hundred to two thousand acres. To facilitate the restoration of ecosystems, at maximum 60,000 acres total would be burned during the growing season (April-October) over the next five years. Prescribed burn plans would be prepared and approved by a qualified

professional on all burn units prior to implementation of any burning activity. See Table A-1 in Appendix A.

The construction of about 73.6 miles of dozer fireline and the refurbishment of about 97.9 miles of fireline to protect private property or other forest resources which may be sensitive to fire would be needed. The firelines may be reused more than once during the burning cycle rotations and in conjunction with the burning of adjacent units.

Table 6. Summary of Treatments in the Current Management Alternative

Actions	Acres
Maximum potential different acres that are prescribed burned	**121,832**
Maximum potential total acres prescribed burned over the next five years	**250,000**
Maximum potential different acres burned during the growing season over next five years between April 1 and October 30. This amount is part of the total 250,000 acres listed above.	**60,000**
Maximum miles of dozer line constructed	**73.6**
Maximum miles of dozer line refurbished	**97.8**

Prescribed burning may occur on up to 5,500 acres within wilderness, to reduce the risk of damaging wildfire which could spread into adjacent areas. Prescribe fire would be ignited manually or allowed to back into wilderness from adjacent uplands on up to 3,000-5,000 acres. Up to 300-500 acres occurring within Wambaw Swamp Wilderness, Compartments 173 and 186 would be ignited directly by helicopter with Regional Forester permission. Prescribed fire in wilderness is authorized in a letter to the Forest from the Regional Forester dated June 22, 2006.

The Francis Marion has burned 3,180 acres within the Santee Experimental Forest to restore longleaf pine on upland sites. Prescribed burning has taken place on the upland pine forests in three different locations within MA1 ranging in size from 170 acres to 836 acres. Coordination with the forest research team leader is necessary before burning takes place due to analysis requirements and the continuing monitoring of the forest stands. The team leader for the Santee Experimental Forest prioritizes locations and time frames of prescribed burns in research areas. All monitoring will continue to be performed by the research team leader.

Alternative 3 (Modified Proposed Action)

This alternative is similar to the proposed action with a rotation of burn blocks to maintain and restore longleaf pine and to reduce fuel build-up in the wildland urban interface. The difference between Alternative 3 and the Proposed Action is that the ignition (aerial or hand) of prescribed fire would be used to address unnatural fuel build-up in three of the four wildernesses on the Francis Marion National Forest. Specific areas that would need ignition within the wildernesses:

- Along the Southern boundary of **Little Wambaw Swamp Wilderness**, there are numerous structures including homes. Aerial or hand ignition along this southern border should create a protective buffer between the swamp and these homes. This buffer of burned fuel is critical during periods of drought when wildfire risk is high. It is anticipated that approximately 500 to 600 acres of Little Wambaw Swamp may burn in a given year from prescribed fire backing into or being ignited in the wilderness area.
- **Hellhole Bay Wilderness** has large pockets of pine forest and high fuel buildup. Portions of this wilderness are outside of the natural fire regime. Hellhole Bay Wilderness is

nearest the communities at risk of Jamestown (approximately 2.5 miles) and Shulerville (approximately 2 miles). If natural ignition occurs during drought conditions in the heavy fuels of this wilderness, fire and smoke production may last several months impacting local communities. It is anticipated that approximately 50 to 100 acres of Hellhole Bay may burn in a given year from prescribed fire backing into or being ignited in the wilderness area

- **Wambaw Swamp Wilderness** is currently managed with prescribed burning and ignition is occurring on about 500 acres in compartment 186. This ignition within the wilderness creates a protective buffer along Halfway creek road and reduces fuel loads along this traffic corridor. This wilderness borders Halfway creek road for about three miles. It is anticipated that approximately 300 to 600 acres of Wambaw Swamp may burn in a given year from prescribed fire backing into or being ignited in the wilderness area
- This decision would not authorize ignition of prescribed fire within the **Wambaw Creek Wilderness**. However, prescribed fire would be allowed to spread into the boundaries of the wilderness from adjacent areas. Approximately 0 to 50 acres would be anticipated to burn in a given year from the spread of prescribed fire into this wilderness area.

Comparison of the Alternatives

The team developed three alternatives to address forest plan direction and the purpose and need. These alternatives are: Alternative 1 (Proposed Action), Alternative 2 (Current Management), and Alternative 3 (Modified Proposed Action). See Table 7 for a comparison.

- Figure 2 displays the difference in area covered in Alternative 1 (Proposed Action) and Alternative 2 (Current Management). The area covered in Alternative 1 (Proposed Action) is the same area covered by Alternative 3 (Modified Proposed Action). The proposed action and modified proposed action not only include prescribed burning in MA1 to maintain and restore fire-adapted ecosystems but also introduces prescribed fire into MA2 to reduce fuel loadings near roads and towns.

- Another difference among the alternatives are the amount of growing season prescribed burning, which is higher in the Proposed Action and Modified Proposed action.

- Fire management in wilderness varies by alternative. Two alternatives include ignition of prescribed fire and all three alternatives allow prescribed fire to spread into wildernesses. Two alternatives allow naturally ignited wildfire to burn as long as human health and safety can be maintained.

Table 7. Summary of Treatments in the Current Management Alternative

Management Action	Alternative 1 (Proposed Action)	Alternative 2 (Current Management)	Alternative 3 (Modified Proposed Action)
Growing Season burn	Increased burning (up 16,500 acres) in the growing season	Prescribed burning a maximum of 60,000 acres would be burned during the growing season (April to October) over a 5-year period	Increased burning (up 16,500 acres) in the growing season.
Management of fire in MA2	Introduce prescribed fire into MA2.	Prescribed fire is not introduced into MA2.	Introduce prescribed fire into MA2.
Fire Management in Wilderness	Prescribed fire is allowed to spread into wildernesses. Naturally ignited wildfires are allowed to burn No ignition of prescribed fire within a Wilderness is proposed.	Prescribed fire is allowed to spread into wildernesses. Naturally ignited wildfires are **not** allowed to burn. Ignition of prescribed fire in Wambaw Swamp Wilderness is proposed.	Prescribed fire is allowed to spread into wildernesses. Naturally ignited wildfires are allowed to burn. Ignition of prescribed fire in three Wildernesses is proposed.

Table 7a below provides a summary comparison of the total acreage that may be expected to burn in wilderness areas in a given year for each alternative.

Table 7a. Comparison of Potential Acres that May Burn in a Given Year Under Each Alternative

Wilderness Area	Alternative 1 (Proposed Action)	Alternative 2 (Current Management)	Alternative 3 (Modified Proposed Action)
Wambaw Swamp	300 to 500 acres	300 to 500 acres	300 to 600 acres
Little Wambaw Swamp	0 to 300 acres	300 to 500 acres	500 to 600 acres
Hellhole Bay	0 acres	0 acres	50 to 100 acres
Wambaw Creek	0 to 50 acres	0 to 50 acres	0 to 50 acres

Design Criteria Common to All Alternatives

Forest Plan standards and guidelines are constraints placed on project and activity decision making. They help achieve or maintain the desired condition or conditions, avoid or mitigate undesirable effects or meet applicable legal requirements. Standards and guidelines are in Chapter 4 Design Criteria of the Forest Plan.

The project-level design criteria pertinent to Species of Conservation Concern (SCC) in this project area include:

- ❖ Known populations for at-risk species will be noted on burn plans to ensure they are prescribed burned at the fire return intervals identified in the land management plan. Populations for nutmeg hickory and bottomland post oak will be burned according to direction in the Francis Marion Forest Plan.

- ❖ At-risk plant species populations will be identified and avoided where possible prior to installing firelines likely to impact them.

Alternatives Considered but Eliminated from Detailed Study

Two alternatives were requested by the public, but were not brought forward for consideration. CEQ regulations part 1502.14 states that agencies shall rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for being eliminated. Reasonable alternatives are those that 1) meet the purpose and need of the proposed action, 2) reduce potential adverse impacts on the human environment, and 3) are feasible from a technical and economic standpoint. Most common reasons to eliminate an alternative: Fails to meet purpose and need, clearly unreasonable, Unreasonable environmental harm, technologically infeasible, illegal, duplication with the existing range or cannot be implemented.

Burn 160,000 Acres Annually

During scoping, a member of the suggested that the Francis Marion prescribed burn 160,000 acres per year to accomplish the maintenance and restoration of fire-adapted ecosystems. During the development of the 2017 Forest Plan, it was noted that the total area that would benefit from fire is approximately 160,000 acres. However, this alternative is technically infeasible due to smoke management requirements and cannot be implemented due to the fiscal and staffing capacity and greatly exceeds the purpose and need of approximately 50,000 acres per year of prescribed fire.

Limit Annual Burning to 50,000 Acres, including Wildfires

An alternative was proposed by a member of the public that included restrictions on the fire program:

- **Set annual burning limits of 50,000 acres, including wildfires**; While the Francis Marion anticipates burning only about 30,000 to 50,000 acres per year, this limit is due to weather, staffing and fiscal capabilities and should not be considered a restriction on the actual need of prescribed fire to restore ecosystems. It cannot be predicted when, how much, and where wildfires may occur and if they will occur in areas needed to address Forest Plan direction. The effects of wildfires are different from a prescribed fire. This suggested alternative does not meet the purpose and need for ecological restoration and does not meet Forest Plan direction to maintain, improve and restore ecosystems and to reduce fuel loadings within MA2.
- **Place limits of 16,500 acres on fire ignited during the growing season by early, mid- and late growing season;** The analysis in the FEIS did not consider the effects of growing season burns by early, mid, and late growing season. Due to the uncertainty of weather conditions and the need to prescribed burn on desired fire return intervals, limits

by early, mid, and late growing season do not meet Forest Plan direction to maintain and restore ecosystems or to reduce fuel loadings.

- **Increase protection of hardwoods;** The effects of prescribed fire on hardwoods were considered in the FEIS. Forest Plan direction on the fire return intervals for the different ecosystems should maintain and restore hardwood ecosystems. Prescribed fire may kill individual hardwood, but Forest Plan direction on ecosystem management should provide for protection of hardwood across the Francis Marion.
- **Report all acres within a compartment not just the blackened pine component.** Standard practice is to report the acres that have burned. It is not feasible to estimate effects of prescribed fire on plants outside of the burned area.

Do not use Prescribed Fire

An alternative with no prescribed burning was considered by the Interdisciplinary (ID) team, but it was not considered in detail because it does not meet the purpose and need to restore ecosystems or reduce fuel loadings near towns and roads.

Modify Growing Season Burn Acreage

In the May 2018 review, it was noted that the Forest Plan has an objective of burning 10,500 to 16,500 acres in the growing season but burning 25,000 to 30,000 acres in the growing season is needed to meet ecosystem restoration objectives. Currently, we are developing the first biennial monitoring report under the 2017 Forest Plan. We need to continue monitoring fire effects before considering if a forest plan amendment to change the number of acres prescribed burned in the growing season is needed.

Issues

Public Involvement on this project included scoping of the proposed action, public meetings, and a 30-day comment period on the preliminary EA. The scoping period ran from July 9 to August 8, 2018. Based on public input, the team identified four issues (see below) to frame the environmental analysis and identified various public concerns and responded to them. This review is documented in a content analysis and response to comments posted on-line as part of the project record. The 30-day comment period on the EA ended on September 25. A content analysis and response to comments was developed and is posted on-line.

Based on public comments received during scoping and team deliberations, four issues were identified for detailed analyses because the effects of prescribed fire activities may be related to potential significance or the ability to meet the need of the project. No new issues were identified during the 30-day comment period, so the following issues were identified and analyzed to determine the potential for NEPA significance:

Issue 1: Prescribed fire can have unintended consequences to habitats for wildlife.

Issue 2: Prescribed fire in the Francis Marion can cause Smoke management concerns.

Issue 3: Prescribed fire can have unintended effects to merchantable timber and mast-producing vegetation.

Issue 4: Fire management in Wildernesses may impact Wilderness character.

Comparison of the Effects by Issues

See Table 8 for a comparison of effects by issues and alternative.

Table 8. A comparison of the effects by issue and alternative

Issue	Alternative 1 (Proposed Action)	Alternative 2 (Current Management)	Alternative 3 (Modified Proposed Action)
Issue 1: The effects of prescribed fire to mast-producing vegetation and habitats for wildlife	Increased burning (up 16,500 acres) in the growing season and introducing prescribed fire into MA2 could have more direct impacts to wildlife and hard-mast plants, but creates more suitable wildlife habitat in the long-term than current management.	Prescribed burning a maximum of 60,000 acres would be burned during the growing season (April to October) over a 5-year period may have fewer direct impacts to wildlife and hard-mast plants than the other two alternatives, but creates less suitable wildlife habitat in the long-term.	Effects are similar to what is described for the proposed action. Due to the ignition of prescribed fire in three Wildernesses, there is a greater potential for direct impacts to wildlife and mast-producing plants, but creates more wildlife habitat in the long-term.
Issue 2: Prescribed fire in the Francis Marion leads to Smoke management concerns	Introducing prescribe fire into MA2 may create some smoke management problems in the short-term, but reduces smoke emissions from a wildfire in the long-term. Allowing prescribed fire to spread into the wildernesses and allowing naturally ignited wildfire to burn would reduce fuel loadings and reduce the potential smoke emissions from a wildfire. No ignition of prescribed fire in the Wildernesses does not address fuel loadings and potential smoke emissions from a wildfire.	Prescribed fire is not introduced into MA2, which does not address potential smoke emissions from a wildfire. Effects of allowing prescribed fire to spread into the wildernesses are similar to those effects described in the proposed action. Not allowing naturally ignited wildfires would not reduce fuel loadings and potential smoke emissions from a wildfire. Ignition of prescribed fire in Wambaw Swamp Wilderness provides a protective buffer adjacent to structures located along the southern border and reduces the potential impacts from smoke emissions.	Effects of introducing prescribed fire into MA2 are similar to the effects in the proposed action. Effects of allowing prescribed fire to spread into the wildernesses and allowing naturally-ignited wildfires to burn are similar to those effects described in the proposed action. Ignition of prescribed fire in three Wildernesses should reduce fuel loading within pockets of pine forest within the swamps. The ignition would reduce the potential smoke emissions from a wildfire especially in a drought.

Issue	Alternative 1 (Proposed Action)	Alternative 2 (Current Management)	Alternative 3 (Modified Proposed Action)
Issue 3: Prescribed fire can have unintended effects to merchantable timber	MA1 is maintained with prescribed fire with some unintended mortality of trees. Introducing prescribe fire into MA2 may kill some trees in the short-term, but reduces potential timber mortality from a wildfire in the long-term. Allowing prescribed fire to spread into wildernesses and allowing naturally-ignited wildfires to burn may kill some canopy trees, but does not affect merchantable timber since timber harvest is not allowed within wildernesses. No ignition of prescribed fire would reduce the direct effects of mortality of overstory trees in the short-term, but increases the potential tree mortality from a wildfire in the long-term.	Effects are similar to those effects in MA1 for the proposed action. The direct impacts for timber mortality in MA2 is less than the proposed action in the short-term, but the risk for timber mortality increases from a wildfire in the long-term. The effects of allowing prescribed fire to spread and ignition of prescribed fire in Wambaw Swamp Wilderness may kill some overstory trees in the short-term, but reduces the potential tree mortality from a wildfire. However, timber sales are not allowed in Wildernesses so no merchantable timber would be killed.	Effects in MA 1 are similar to those effects described for the proposed action. Effects from prescribed fire management in MA2 are similar to those effects described for the proposed action. Effects from allowing prescribed fire to spread, allowing naturally ignited wildfires to burn and igniting prescribed fire would be increase the potential mortality of overstory trees in the short-term, but reduces the potential tree mortality from a wildfire in the long-term. Similar to the Proposed Action and Current Management alternatives, no timber sales are allowed in Wildernesses, so no merchantable timber is impacted.

Issue	Alternative 1 (Proposed Action)	Alternative 2 (Current Management)	Alternative 3 (Modified Proposed Action)
Issue 4: Ignition of prescribed fire in wilderness is needed to address fuel loading and allow fire to play its natural role.	Prescribed fire is allowed to spread into wildernesses. The natural quality of wilderness is maintained in the short-term, but the potential for a stand-replacement wildfire increases in the pockets of pine forest in the long-term. Naturally-ignited wildfires are allowed to burn as long as human health and safety are not at risk, which maintains the untrammeled and natural qualities of wilderness character. No ignition of prescribed fire is proposed so direct effects to wilderness character are limited in the short-term. Unnatural fuel loadings may result.	Effects from allowing prescribed fire to spread into the Wildernesses are similar to the effects described for the Proposed Action. Naturally-ignited wildfires are not allowed to burn and suppression activities would affect the untrammeled quality in the short-term, but the natural quality in the long-term Ignition of prescribed fire in Wambaw Swamp Wilderness temporarily affects the untrammeled quality, but effects are not noticeably different from a naturally ignited wildfire. This alternative addresses unnatural fuel loadings in Wambaw Swamp Wilderness.	Effects from allowing prescribed fire to spread into the Wildernesses are similar to the effects described for the Proposed Action. Naturally-ignited wildfires are allowed to burn and effects are similar to those impacts to wilderness character described for the Proposed Action. Ignition of prescribed fire in three Wildernesses temporarily affects the untrammeled quality, but effects are not noticeably different from a naturally ignited wildfire. This alternative addresses unnatural fuel loadings in three Wildernesses.

Environmental Effects

Prescribed fire activities and associated effects described in this EA are consistent with the 2017 Forest Plan and associated Final Environmental Impact Statement (FEIS) posted on-line at https://www.fs.usda.gov/detail/scnfs/landmanagement/planning/?cid=FSEPRD575346. The analysis in this EA is tiered to the analysis in the FEIS associated with the 2017 Forest Plan. This EA incorporates by reference the affected environment and effects analysis from the 2006 EA, *Prescribed Fire on the Francis Marion National Forest*. The 2006 EA is posted on-line in the supporting information for this project.

Past, Present and Foreseeable Projects Considered for Cumulatively Effects

- Current and foreseeable timber sales on the Francis Marion.
- Prescribed fire operations on other ownerships.

The Environmental Effects section is divided into two parts:

- **Resources with No Concerns for NEPA Significance** - For some resources, no issues related to NEPA significance were identified by the public or the ID team. A summary of the effects is provided below and the specialists' reports are filed in the process record. The environment analyses for these focuses on compliance with relevant laws, regulations, and policy for these resources. These resources are broadly divided into Social Resources and Biological and Physical Resources.
- **Effects Analyses by Issues** - More detailed effects analyses are included for the four issues identified in the Issues section of this EA.

Resources with No Concerns for NEPA Significance

Social Resources

Lands and Special Uses –Coordination with special uses permit holders is considered in the burn plan and site-specific measures are incorporated into the burn plans as needed. Prescribed fires are conducted on other ownerships with landowners with appropriate agreements. These processes on review and coordination will not change regardless of alternative selected.

Procedures to process special use requests and land adjustments are described in law and policy and will not change regardless of alternative selected. Similarly for on-going timber sales or prescribed fire activities on other ownerships, these management activities will not affect the procedures to process special use permits or land adjustments.

Community Wildfire Protection Planning - Due to a successful history of prescribed fire in MA1 of the Francis Marion, significant portions of the national forest are in fire regime condition classes 1 and 2 (ie meeting desired fire return intervals in Table 5), which reduces the risk of a catastrophic wildfire. The prescribed fire strategy on the Francis Marion currently is to maintain ecosystems with frequent prescribed burning rotations. Continuing to follow this strategy in all three alternatives would allow managers to maintain condition class 1 areas and move condition class 2 areas into condition class 1, which reduces wildfire risks. Increasing the current core area of burning as proposed in the proposed action and modified proposed action would also result in

moving additional condition class 2 areas into condition class 1 while beginning to further move condition class 3 areas into condition class 2 and reducing wildfire risks.

Current management (Alternative 2) carries the greatest wildfire risk. By not treating the build-up of hazardous fuels within fire dependent ecosystems in MA2, these systems will continue to display uncharacteristic fire intensity and fire severity characteristics. These uncharacteristic fire intensities are more difficult to react to and suppress and are more unpredictable. By not treating the build-up of hazardous fuels within fire-dependent ecosystems in the wildland-urban interface, these systems would continue to display uncharacteristic fire intensity and fire severity characteristics. These uncharacteristic fire intensities would be more difficult to react to, suppress, and predict. The proposed action (Alternative 1) and modified proposed action (Alternative 3) would provide the greatest opportunity to reduce the threat and risks associated with wildland fire. The proposed action (Alternative 1) and the modified proposed action (Alternative 3) would increase the area burned and the return interval frequency in the growing season.

All three alternatives would provide increased opportunities for Federal, State and private partners to work together while creating fire-adapted human communities. By working with partners and homeowners to reduce hazardous fuels, the likelihood that a wildfire burning in adjoining vegetation would ignite homes or other structures can be mitigated.

The proposed action (Alternative 1) and modified proposed action (Alternative 3) would provide the greatest opportunity to reduce the threat and risks associated with wildland fire. The proposed action (Alternative 1) and the modified proposed action (alternative 3) would increase the core area burned and the return interval frequency in the growing season.

As repeated prescribed fire is implemented, a grass- and forb-dominated understory would prevail over a larger part of the landscape reducing the risk from a wildfire. In this condition, surface fuels are the primary component contributing to fire behavior. There would not be as much of a woody live and dead fuels component to contribute to flaming. Suppression efforts would be less costly while providing a higher degree of safety to both the public and firefighters.

Recreation- The Forest provides three recreation areas, two campgrounds, one primitive campground, three boat launches (with their subsequent water trails), one visitor center, two shooting ranges and eight trails providing opportunities for non-motorized (hiking, biking, equestrian) and motorized uses. Over 120 miles of hiking, biking, interpretive and equestrian trails are offered within the boundaries of the Francis Marion National Forest. The Francis Marion National Forest has 40 miles of legally designated motorized off-highway vehicle (OHV) trail.

Due to the forest plan standards and guidance in burn plans, effects to recreation resources and forest visitors are limited Recreation staff provide input on the burn plans on measures to limit any potential impacts to recreation areas, trails, and scenic areas. Developed recreation sites, access roads, and trails are temporarily closed during prescribed fire and mop-up operations to provide for visitor safety. As with all developed sites and forest service structures and improvements, appropriate measures will be taken to ensure the prescribed fire is contained within its fire lines. Trail improvements such as bridges, bulletin boards, trail blazes, sign posts and signs, traffic control devices at trailheads, and garbage containers are generally protected via raking around or other required site-specific mitigation. Where trails are located, after prescribed fire operations, the surrounding area is blackened, but effects are temporary and green-up of burned vegetation generally occurs within a few months.

In the proposed action and the modified proposed action, the introduction of prescribed fire into portions of the Francis Marion that has not been burned within several years would have effects similar to what is described above. Design criteria are designed to protect forest visitors and limit effects to recreation facilities. (See Section 4.2.17 Standards for Recreation and Scenery in the Forest Plan.)

The repeated implementation of burning activities in areas adjacent to the hiking, biking and equestrian trails augments the recreation experience by providing openings for wildlife and bird watching, while increasing the diversity of plant communities, particularly those containing native grasses, herbaceous wildflowers, and carnivorous plants.

No cumulative effects are anticipated, the review process and protection of forest visitors and facilities would remain in place regardless of the alternative selected. Similar review and public precautions are incorporated for timber sales on national forest lands. Prescribed fire activities on other ownerships may generate smoke emissions that temporarily affect forest visitors.

Scenery- The Francis Marion is located on the coastal plain of South Carolina, loblolly pine dominates the upland sites, longleaf pine is prevalent and bottomland hardwoods and swamp hardwoods dominate the wetter sites. Most of the area is rural with inclusions of residences and crossroad communities. Scenery is dominated by forested lands and occasional inclusions of private lands. (See OBJ-MUB-1. Scenery and Section 4.2.17 Standards for Recreation and Scenery in the Forest Plan.)

Directly, smoke, blackening of vegetation and firelines (both construction and refurbishing) are the primary visual impacts of prescribed burning. Though not visually appealing, these conditions are short term, except in the case of the firelines and mitigation includes reshaping and smoothing those firelines to reduce the visual impacts over time. Direct visual effects of the burn are generally lessened in 3-4 months and are nearly invisible by the next growing season. The smoke from prescribed burning may also be a temporary unpleasant visual experience for the public. Direct impacts to scenery in MA2 may be greater under the Current Management alternative due.to the increased risk of wildfire. In the short-term, effects are less because blackened plants are not visible. In the proposed action and modified proposed action, introducing prescribed fire into parts of MA2 that have not been burned in several years would have direct effects similar to what is described above. Smoke emissions may be higher in the short-term, but effects are temporary, and efforts are taken to encourage dispersal.

Indirectly, prescribed fire would benefit the visual quality of the forest over time. Fire-maintained pine stands, woodlands and savannas add to the diversity in the larger forested area. Diversity in any landscape generally enhances scenic beauty. The understory of the fire-maintained areas will be more diverse both ecologically and visually. Scenic quality would benefit from the burning.

The repeated implementation of burning activities in areas along roads augments the viewing experience by providing openings for wildlife and bird watching and increased plant diversity. No cumulative effects to scenery are anticipated. No land use changes are proposed and effects are within the range of what is described for Scenery in the FEIS.

Hunting - The Francis Marion offers the largest and most consolidated area available for public hunting in South Carolina. Cooperative game management areas were established in 1937 by the Forest Service and the State Wildlife Resources Department. Since 1971, most of the Forest has been cooperatively managed in five Francis Marion National Forest Wildlife Management Areas

(WMAs). Indirect effects on hunting opportunities include that open areas will become more prevalent. The proposed action and modified proposed action introduce prescribed fire into parts of the Francis Marion that have not been prescribed burned in several years, which would improve opportunities for hunting in those areas. The repeated implementation of burning activities in the Francis Marion augments hunting opportunities by providing openings, while increasing the diversity of plant communities. Cumulatively, timber sale activities and prescribed fire activities on other ownerships would augment hunting opportunities in those respective areas.

Deer, wild turkey and other game are fire-adapted species and indirect effects include benefits from the open areas and herbaceous grasses and forbs resulting from prescribed fire. However, the improvements in habitat outweigh the loss of individuals. Nesting habitat for Eastern wild turkey is indirectly benefited by prescribed fire because prescribed fire increases the dominance of herbaceous grasses and forbs in the understory of pine stands, providing nesting and foraging habitat for Eastern wild turkey. Turkeys prefer to nest in areas that have been prescribed burned within the last two years. This behavior reduces potential impacts to nests from the proposed fire program. Similar for deer, increased prescribed burning in the growing season increases the amount of available habitat. Prescribed fire and timber management would augment habitat for many game species.

Prescribed fire in the growing season may have direct effects to some fawns and turkey nests or poults. These effects would be higher in the proposed action and the modified proposed action due to the increased number of acres of prescribed fire proposed in the growing season. Growing season burns may negatively impact activities of individuals but would not likely cause a downward trend in populations in the huntable wildlife.

Subsistence/Environmental Justice- Most activities will occur on National or Experimental Forest lands and no disproportionate impacts to minorities, children and people living in poverty are anticipated. Regardless of alternative selected, the Francis Marion will continue to provide opportunities for subsistence collections.

Eligible Wild and Scenic River - During the revision of the Francis Marion Forest Plan, the following rivers were found to be eligible for wild and scenic designation: The Lower Santee River, Wambaw Creek, Echaw Creek, Wadboo Creek and Awendaw Creek. Management emphasis for the eligible rivers and their corridors is focused on protection and enhancement of the values for which they were established, without limiting other uses that do not substantially interfere with public use and enjoyment of those values. The establishment outstandingly remarkable values for the eligible wild and scenic rivers on the Francis Marion National Forest include scenic, recreational, geological, fish and wildlife, historical, cultural or other values including ecological.

Fire management within the eligible wild and scenic river corridors include prescribed fire and fire suppression actions that may result in smoke impacts, noise from aircraft, chainsaws and engines, or visual effects from charred vegetation. These effects are temporary. Noise from equipment would occur only during the operations and charred vegetation would green up rapidly. These effects from prescribed fire to scenery were considered in the FEIS and effects from the prescribed fire activities proposed are within those effects. Under all alternatives, the five eligible wild and scenic rivers would have their eligibility maintained in accordance with Forest Service Manual and Handbook direction until they are evaluated for their suitability and either designated or released. They would be maintained in their free-flowing condition and their

identified outstandingly remarkable values would be retained. (See Section 4.2.1. Standards for Eligible Wild and Scenic River in the Forest Plan).

The combined effects of on-going timber sales and the alternatives should not have any cumulative effects on the eligibility of these five rivers. Potential timber sales are evaluated separately for potential impacts to the eligible wild and scenic rivers. Prescribed fire on other ownership does not change land use or increase development.

Biological and Physical Resources

Aquatic Habitats and Water Quality– Aquatic ecosystems consisting of fresh, brackish and tidal rivers and streams including ephemeral streams occur across the Francis Marion National Forest. Tannic stained blackwater streams are the most common stream type on the Francis Marion and originate in the coastal plain, primarily on the national forest. Rivers and streams and their connectivity to riparian areas, floodplains, and wetlands provide a rich diversity of habitat for aquatic species and fauna. Streams on the Francis Marion are primarily fresh water, with some tributary streams of the Santee, West Cooper, Wando Rivers and smaller coastal streams containing brackish waters during tidal cycles. There are 2,499 stream miles within the administrative boundary and 1,460 miles on national forest land. Of the 2,499 stream miles, approximately 1,274 miles are perennial streams and 1,225 miles are intermittent streams.

Due to the relatively flat topography and sandy soils, very limited impacts to water quality and aquatic habitats from sedimentation are anticipated. To limit impacts the Francis Marion does not use an extensive network of constructed firelines, but relies on natural fuel breaks, such as roads and streams (See Section 4.2.2.3 Guidelines for Prescribed Burning and Wildfire Suppression in the Forest Plan). In all alternatives, streams are protected with specific riparian management zones that minimize pollution and maintain riparian areas and aquatic habitat. Furthermore, in 2012, the Forest Service published guidelines for "National Best Management Practices for Water Quality Management on National Forest System Lands" (USDA Forest Service 2012) as guidance in developing protective measures to maintain and improve water quality. All national forests are instructed to follow the National Best Management Practices, including monitoring for compliance.

Cumulatively, environmental consequences to water from past, present, and foreseeable timber sales are minimized for all alternatives through the use of best management practices, proper design criteria, careful planning, design, implementation, and monitoring. When done in accordance with the forest plan direction, impacts to the water resource and aquatic habitats from the prescribed fire and connected actions are not expected to have a cumulative effect. Overall, the cumulative effects of all management actions over time are not expected to have an additive affect to the water resources or aquatic habitats at the watershed scale.

Species of Conservation Concern (SCC) - All alternatives would be consistent with the desired conditions, objectives, and standards and guidelines in the 2017 Revised Land Management Plan. All of the SCC have been linked to coarse and fine filter forest plan strategies which are critical to their survival and long-term persistence on the landscape (Appendix 1 and FEIS, Appendix E – Table E46). Of the 70 SCC species identified on the forest to date, 51 species are associated with OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration and directed through Forest Plan S41. Of the 70 SCC species, 55 are plant species subject to S26 – which prohibits locations for firelines in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety, and S42 – Identify and mark at risk

plants in locations of federally listed plant species in order to avoid negative impacts to plants from management activities. Other applicable standards and guidelines designed to conserve SCC include: S17, S18, S22, S25, S26, S34, S36, S37, S41, S42, G12, G13, G14, G15,G 16, G17, and G40).

Non-Native Invasive Species - Non-native invasive species including insects and diseases (emerald ash borer, sudden oak death, laurel wilt, Asian longhorn beetle, fire ants, and sirex wood wasp), animals such as feral hogs and nine-banded armadillo, and non-native terrestrial and aquatic species, all occur and/or have the potential to spread on the Francis Marion National Forest (FEIS, pp.212-227). Forest plan desired conditions, standards and guidelines (S34, S36, G39-G41) will help mitigate the introduction and spread of non-native invasive species - particularly plants - on national forest and other lands. Management strategies will focus on prevention, detection, education, and eradication of priority pests and areas across all alternatives consistent with Executive Order 13112 (Invasive Species) and Forest Service policies, resources permitting. Direct effects of the proposed alternatives on the introduction and spread could occur incidentally by equipment, people, and vehicles, and will be minimized through education, early detection and response, and equipment cleaning provisions. Indirectly establishment of non-native invasive plants is most likely in areas of exposed soils resulting from fire line construction or high intensity burns (Evans et.al., 2006). Cumulatively, the spread of non-native invasive species is likely to continue to increase across the landscape across all alternatives. Forestwide and forest plan monitoring for the introduction and spread of non-native invasive plant species will identify priorities for detection and response to help mitigate the spread of non-native invasive species across all alternatives.

Soil Quality - Overall, most soils on the Francis Marion are adequately fertile; however, the poorly drained soils have low fertility levels and hydrous oxides of iron and aluminum that restrict pine tree growth. Soils within the Francis Marion are stable with little erosion occurring across the area. Soils are intact and serve as a medium for root growth and soil organisms.

Prescribed fire effects on soil quality were considered in the FEIS and the described effects are within those considerations, which were used to develop Forest Plan standards and guidelines. (See Section 4.2.2.3 Guidelines for Prescribed Burning and Wildfire Suppression in the Forest Plan). Connected actions with prescribed fire include the potential need of bladed or plowed firelines. Blading or plowing firelines exposes the mineral soil by removing vegetation, leaf litter, and duff. Blading or plowing would increase the exposed area's susceptibility to soil erosion and displacement of nutrients and organic matter offsite. Firelines that are rehabilitated can recover quickly when they accumulate litter from a forest canopy or are treated with erosion control measures to control concentrated flow and reduce soil exposure through revegetation efforts. Firelines that are needed for frequent or regular burning cycles are best designed and maintained on the landscape to provide for both long-term use and ability to control concentrated flow and erosion by employing relatively permanent erosion control measures when not used.

Fire's effects on soil properties and processes is quite varied and depends largely on fire intensity, fire severity, temperature, fuel type and amount, soil moisture, season, and other factors. In general, prescribed burns are designed to burn with minimal effects to soil by removing vegetative cover and litter while protecting the duff and humus layers of the soil. Potential adverse effects may be mitigated by burning at certain times of the year, at certain fuel moisture thresholds and under meteorological conditions that limit impacts to soil productivity. This information is provided in the burn plan prepared for each prescribed fire.

Effects to soil quality from prescribed fire were considered in the FEIS for the Forest Plan. The application of forest standards and guidelines as well as national and State best management practices would minimize the impacts on soil quality when implemented properly and in a timely manner. With design criteria, impacts to soils would be limited and are not expected to exceed soil productivity thresholds for any alternative or when considered with timber sales or prescribed fire activities on other ownerships.

Cultural Resources–The affected human environment includes aesthetic, historic, and cultural resources within the proposed prescribed burn areas on the Francis Marion National Forest. More than 5,000 archaeological sites have been recorded on the forest and represent the most common expression of the human environment. Historic buildings and structures represent the next most common expression of the human environment. This includes four historic buildings and two fire lookout towers.

Most archaeological sites on the forest lack combustible materials and are not threatened by low- to moderate-intensity burning. Fire can affect archeological materials located on or near the surface depending on the temperatures and duration of the burn. Most subsurface deposits are not affected as a 10 cm layer of soil is sufficient to protect most archaeological material. However, heavy duff, surface logs, and stumps and roots that smolder can expose subsurface materials to heat.

The use of heavy equipment to construct new firelines or refurbish previously constructed fire breaks has a greater potential for adversely affecting archaeological sites. Pushing new fire breaks has the potential to impact sites with shallow deposits through soil compaction and displace of cultural material.

Prescribed burning can have indirect effect of making cultural resources more visible and thus susceptible to vandalism primarily from unauthorized and illegal excavation and metal detecting in order to collect artifacts.

The forest has sought to use natural or existing breaks, such as creeks and roads, to reduce or reduce or eliminate the need to mechanically construct firelines using heavy equipment. Most of the prescribed burning blocks on the Francis Marion National Forest utilize the same firelines or natural breaks repeatedly to control fire and reduce unintended impacts on the forest. Once a fireline is established it can often be refurbished using hand tools such as rakes and leaf blowers to clear organic forest litter.

Prior to initiating a prescribed burn the forest prepares burn plans that are reviewed by staff cultural resource specialists to determine if there are any specific concerns about how the burn could affect the cultural resources. The review determines if the area has been previously inventoried for cultural resources and identifies any known resources that could be affected by fire or fireline construction. For areas not previously inventoried a phased inventory is used to identify cultural resources as new fire breaks are established. Possible effects to cultural resources were analyzed as part of the FEIS for the Forest Plan. Standards and guidelines as well as site-specific measures incorporated in the burn plans limit impacts to known cultural resources.

Carbon Storage and Sequestration - The prescribed fire alternatives affect a relatively small amount of forest land regionally and carbon on the National Forest name and might temporarily contribute an extremely small quantity of Greenhouse Gas (GHG) emissions relative to national and global emissions. Keeping forests as forests is one of the most cost-effective carbon storage measures. None of the alternatives proposed to convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the prescribed fire activities to have a temporary

influence on atmospheric GHG concentrations, because carbon will be removed from the atmosphere over time as these highly productive forests regrow. All alternatives are consistent with internationally recognized climate change adaptation and mitigation practices. Cumulatively, on-going timber sales on national forest lands and the use of prescribed fire on other ownerships would maintain highly functioning ecosystems and maintain forests as forests across the Francis Marion.

Climate Change - Maintaining highly functioning ecosystems across the landscape is the most effective response to potential changes in climate. All three alternatives restore and maintain ecosystems. Partnerships with adjacent landowners that create avenues or mitigation corridors for species migration is critical. In all three alternatives, prescribing burning on other ownerships through the use of Wyden agreements or Good Neighbor authority would help provide these migration corridors. These corridors may prevent pockets of isolated species. The South Atlantic Landscape Conservation Cooperative, along with partners, is creating a regional plan to promote conservation across a multi-state landscape. The Forest Service is an active partner that links the Francis Marion to the broader landscape. Cumulatively, on-going timber sales on national forest lands and the use of prescribed fire on other ownerships would maintain highly functioning ecosystems across the Francis Marion.

Effects Analyses by Issues

Issue 1: The effects of prescribed fire to habitats for wildlife.

Affected Environment

Section 3.3 (Biological Environment, pages 101-135) of the FEIS describes the current condition for each modeled ecosystem on the Francis Marion National Forest. Section 2.2.1 (Ecosystem Maintenance and Restoration, pages 20-39) of the Forest Plan further describes the desired condition and management objectives for each ecosystem. The analysis included herein tiers to the analysis provided in the Forest Plan FEIS and incorporates the FEIS and Forest Plan by reference.

Effects of Prescribed Burning to Wildlife Habitat:

Upland Longleaf and Loblolly Pine Woodlands

The upland longleaf pine woodland ecosystems occur on upland landforms of sandy flats with occasional low rolling hills. A key feature of this ecosystem is the drier, non-wetland sites with coarse, well-drained soils that naturally support frequent fire. The vegetation in this system is adapted to frequent fires. Open, loblolly pine-dominated woodlands, which support diverse plant and animal communities, will occur until conversion to longleaf pine can be completed. Where open loblolly pine woodlands provide high-functioning nesting and foraging habitat for red-cockaded woodpeckers and other plant and animal species, the conditions are maintained. In the long term, loblolly pine forest types are converted to longleaf pine.

Variations in upland longleaf plant communities within an ecosystem differ somewhat in composition on xeric to dry, dry-mesic to mesic, and dry to dry-mesic sites, but generally the overstory is dominated by longleaf pine. The mesic phase occurs on moderately well-drained soils, dry-mesic phase on well-drained soils and the xeric phase on excessively to somewhat excessively drained soils.

The desired future conditions for upland pine ecosystems would include longleaf pine as the most common and dominant tree canopy species, but many associations have an understory of scrub oaks, including runner oak, blackjack oak, bluejack oak or turkey oak on the most xeric examples. Shortleaf pine may occur as a canopy species. Ericaceous shrubs, including dwarf and black huckleberry, dangleberry and deerberry, and runner oak or oak tree sprouts may be common in these systems. Upland longleaf woodlands, along with loblolly woodlands and wet pine savanna, form a matrix of pine forests which support a primary core population of the federally endangered red-cockaded woodpecker and provide ecological conditions needed by many other wildlife species (e.g., Bachman's sparrow and Northern bobwhite quail) and at-risk species (e.g., American chaffseed).

Native grasses and forbs, including a ground cover dominated by bunchgrasses (such as little and big bluestem, and golden and slender Indian grass) and with abundant native legumes and forbs (e.g., grass-leaved golden aster, spurred butterfly pea, Maryland golden aster, bush clover, silvery lespedeza, downy trailing lespedeza, stiff coreopsis, goat's rue and black root).

The Revised Forest Management Plan, 2017 outlines the maintenance and restoration of at least 51,500 acres of upland longleaf ecosystem where appropriate site conditions exist. The primary ecological process used to maintain and restore upland longleaf is prescribed fire and timber management. The natural fire return interval in upland longleaf ranges from 1 to 3 years, with a desired return interval of 2 years. Frequent fire is required to maintain low fuel loading and increase the likelihood of creating a more mosaic habitat. The use of frequent fire will allow for more patchiness in burned and unburned areas, which creates a diversity of habitat types within the same ecosystem. Given the pyrogenic nature of longleaf pine, it is undesirable to have longer fire return intervals (>3 years) due to the likelihood of deleterious effects on timber and wildlife resources. Species such as Northern bobwhite quail, Bachman's sparrow, Dusky roadside skipper, and Rafinesque's big-eared bat rely heavily upon upland longleaf pine ecosystems for a portion of their life cycle, and represent a suite of species associated with this ecosystem.

Most wildlife species associated with upland longleaf ecosystems depend upon open conditions with a light to moderate mid-story/overstory and a highly diverse ground cover. The attributes of high-quality upland habitat are significantly correlated to the frequent use of prescribed fire. Most plants and wildlife species associated with this ecosystem have evolved with and are adapted to the presence of frequent fire. Both Northern bobwhite quail and Bachman's sparrow show a preference for open canopy forests with a grassy understory, which be one result of frequent prescribed fire. The dusky roadside skipper and Rafinesque's big-eared bat utilize open pine forest for foraging. Flowering plants are encouraged by frequent burning and result in diverse pollinator habitat and foraging habitat and cover for a number of wildlife species. If the appropriate fire return interval (1-3 years) is applied, then a minimum of 51,500 of high-quality upland pine should be maintained across the landscape. Additionally, seasonality plays an important role in the maintenance of upland pine, and every third burn in these systems should be growing season (April 1 to September 30). The diversity in return interval and seasonality should provide a high-quality habitat that is suitable to a whole suite of wildlife species.

Wet Pine Savanna and Flatwoods

The wet pine savanna and flatwoods system is abundant on the forest, occurring on seasonally wet mineral soils on low areas within beach ridge systems and aeolian sand deposits, and on poorly drained clayey, loamy or sandy flats, particularly across the Cainhoy ridge, where many high-quality examples may be found. The vegetation is adapted to frequent, low-intensity fire.

The potential extent in Management Area 1 is approximately 58,100 acres. Variations in wet pine savanna and flatwoods communities occur on mesic and wet sites where they may differ somewhat in composition, structure and function.

Open loblolly pine-dominated flatwoods and savannas may occur until conversion to longleaf pine can be completed. Where open loblolly pine woodlands provide high-functioning nesting and foraging habitat for endangered red-cockaded woodpeckers and other plant and animal species, existing overstory conditions are maintained. In the long term, the loblolly pine forest types are converted to longleaf pine on the mesic sites and pond cypress or pond pine on the wettest sites.

The Revised Forest Management Plan, 2017 outlines the maintenance and restoration of 86,200 acres of wet pine savannas and flatwoods where appropriate site conditions exist. The primary ecological process used to maintain and restore these systems are prescribed fire. Frequent, low intensity fire averaging every 1 to 3 years is common. Fires are low to moderate intensity resulting in topkill of woody midstory. Associated plants and animals, including longleaf pine, are long lived and colonize available sites over time. Flowering plants and associated pollinators are abundant, triggered by burning and provide foraging habitat and cover for a number of wildlife species. Prescribed burning mimics the spread of natural fire, beginning in the uplands and spreading into the wetlands. These ecosystems are seasonally wet, sometimes with a high water table. Flooding and fire may cause changes in vegetation, particularly at ecotones.

The vegetation type and density within these systems can be variable and lend themselves to the creation of high-quality wildlife habitat. Wet pine savannas and flatwoods ecosystems support a very high diversity of plant and animal species per unit area, including red-cockaded woodpecker, frosted flatwoods salamander, Carolina gopher frog and monarch butterfly. These areas are popular for wildflower viewing and include several species of orchid (grass pink, rosebud, fringed and fringeless) and carnivorous plants (yellow trumpet and hooded pitcher plants and yellow and purple butterworts), and several species of milkweed. Many game species such as Northern bobwhite quail, Eastern wild turkey and white-tailed deer are common. The wildlife species associated with these systems are adapted to the presence of fire on the landscape, and in most instances rely on fire to maintain the appropriate conditions necessary to complete their life history cycle. If fire is applied at the appropriate return interval (1-3 year rotation) and if seasonality if varied then then wildlife species should have a generally positive response to the use of prescribed fire.

Depressional Wetlands and Carolina Bays:

Carolina bays and depressional wetlands occur as isolated patches across the landscape, but generally occur in the sand ridges of the longleaf pine matrix and include an herbaceous ecotone or transition area between these and upland and wet-to-mesic longleaf pine ecosystems.

Depressional wetlands and Carolina bay ecosystems are characterized by soils that are semi-permanently or permanently saturated from processes such as groundwater seepage, perched water tables, rainfall or beaver activity. Some are contained within riparian areas as depressional features. The patch size ranges from 1 to 50 acres and the potential extent is approximately 6,400 acres within management area 1 and approximately 2,400 acres in management area 2. Some important examples of this ecosystem are dominated by pond cypress savannas or herbaceous meadows and are included as designated critical habitat for the frosted flatwoods salamander. Because the basins are often isolated from larger water bodies and most dry out occasionally,

their aquatic fauna does not include fish, unless fish have been introduced through hydrologic modifications and flooding. The bays and wetlands provide some nesting habitat for wood ducks and breeding habitat for Carolina gopher frog and frosted flatwoods salamander. This system supports populations of amphibians and reptiles, including frogs such as the ornate chorus frog, tree frog species such as the barking tree frog, salamanders such as Mabee's salamander, turtles such as the chicken turtle, and snakes such as the crayfish snake.

A variety of vegetation types are present, depending on the size, depth and frequency of fire, but highest quality examples have an intact native herbaceous groundcover, both within ponds and in the adjacent upland ecotone. Vegetation composition often varies from year to year in response to differences in water levels and drawdown times. The ecotone of these depressions is intact and predominantly herbaceous. Carolina bays have a sand rim often dominated by xeric upland longleaf pine. Wetland-associated species such as panic grasses, rushes, spikerushes, beak-rushes, meadow beauties and marsh-pinks are present and dominate the herbaceous layer.

Historical fire return intervals for this ecosystem is 1-6 years with a desired return interval of 3 years. The fire return intervals of individual depressional wetlands and Carolina bays will vary depending on which management area they are located in and time of year burned. Depressional wetlands and Carolina bays in management area #1 will have shorter return intervals than those located in management area #2. Likewise, those depressional wetlands and Carolina bays burned in dormant and/or early growing season when water is present would have longer return intervals than those that are burned in late growing season or when water is absent. Similarly, fire effects to wildlife habitat in this ecosystem would be varied depending on time of year burned and the presence or absence of water. Prescribed fire entering these isolated wetland habitats from the adjacent upland pine habitat during the dormant season or when water is present would have minimal effects to the ecotone allowing a hardwood/shrub ring around the perimeter of the wetland providing cover and nesting habitat for game and non-game species such as bobwhite quail, eastern wild turkey, prairie warbler, common yellow throats, etc. While, fire entering these systems during late growing season when water is absent would reduce hardwood shrubs in the ecotone creating a more herbaceous groundcover and could burn across most of or the entire wetland creating more suitable habitat for frosted flatwoods salamanders, Carolina gopher frogs and other reptiles and amphibians.

The Francis Marion Forest Land Management Plan states for these systems that frequent, low-intensity fire is maintained at 3 year average fire return intervals. Seasonality of burns and weather conditions will vary overtime ensuring that no one area will be prescribed burned strictly during the growing season or the dormant season. In fact, it is estimated that for each individual area there will be only one growing season burn conducted every nine years (one growing season burn every third burning cycle). The only exception to this will be in areas within the designated critical habitat for the Frosted Flatwoods salamander where these areas will likely be on a 2-yearfire return interval in the late growing season. Burning as described will be maintained overtime in this ecosystem with minimal effects to wildlife habitat.

Pocosins

Pocosins are evergreen, shrub-dominated ecosystems which occur in small basins with seasonal to permanent standing water where the accumulation of organic matter exceeds decomposition, resulting in up to 10 feet or more of peat over a period of decades. Vegetation is typically zoned. The lowest strata vegetation occurs in the center of the system, often called "low pocosin" and in areas that are most nutrient poor and averaging 3 feet in height. Along outer zones, "tall pocosin"

(including woodlands with pond pine) may be found. The most common tree in these ecosystems is pond pine which has serotinous cones, meaning the cones open and release seed after being exposed to the heat from fire. Other embedded plant communities include native canebrakes and seepage swamp, pocosin and baygall ecosystems. Pocosin ecosystems occur as patches across the landscape, but generally within the wetlands portion of the forest matrix. Some pocosin ecosystems can be extensive, ranging in size from the 1,200-acre Ocean Bay to the 40-acre pocosins found in the interior of some Carolina bays or depression ponds.

The Revised Forest Management Plan, 2017 outlines the maintenance and restoration of at least 7,200 acres of pocosins where appropriate site conditions exist. The primary ecological process used to maintain and restore pocosins is prescribed fire. The natural fire return interval in pocosins ranges from 2 to 10 years. Areas that are in the restoration phase will most likely receive fire on a shorter return interval. Generally, the edges of pocosin that interface with the adjoining uplands receive fire on a more frequent interval that the interior of the pocosin. The pyro-diversity (both return interval and severity) within the pocosin provides a very mosaic landscape within this habitat type. The mosaic nature of pocosins lends itself to being valuable to a wide variety of wildlife species for cover, food, and breeding habitat. Pocosins are vegetatively dense and provide excellent escape cover for wildlife species. Species such as Black Bear, Eastern cottontail rabbits, Berry's skipper, Yellow-breasted chat, and Eastern diamondback rattlesnake are just a few of the species that rely heavily upon pocosins for a portion of their life cycle. Both Berry's skipper and the Eastern diamondback rattlesnake are species of conservation concern and require additional management attention. The effects of prescribed fire on pocosins and their related wildlife species will generally be beneficial given the mosaic nature of fire within the pocosins. If the appropriate fire return interval (2-10 years) is applied, then a minimum of 7,200 acres of high quality pocosin should be maintained across the landscape. Additionally, seasonality plays an important role in the maintenance of pocosins. Pocosins are generally too wet to burn during the dormant season (October 1 – March 30), and therefore every third burn should be a growing season burn (April 1 – September 31). The diversity in return interval and seasonality should provide a high-quality habitat that is suitable to a whole suite of wildlife species.

Oak Forests and Mesic Hardwoods Ecosystem:

The Oak Forest and Mesic hardwood ecosystem consists of forests dominated by a diversity of hardwood tree species, and may include shortleaf and loblolly pine on dry sites or loblolly and spruce pine on mesic sites and comprises 5,800 acres of the Francis Marion National Forest. Of these 5,800 acres only 1,900 acres occur in MA1 with the remaining 3,900 acres occurring in management area 2. Combinations of upland oaks (particularly white, Southern red and post oaks) occur on more xeric sites. Mesic forests are more diverse and may be dominated by American beech; oaks (cherrybark, laurel, Shumard's and upland laurel); and hickories (pignut, nutmeg and mockernut). Other woody plants may include basswood, Southern sugar maple and American holly; with occasional shortleaf, loblolly and spruce pine. Woody shrubs are typically present and include beauty-berry, red buckeye, sweetshrub and horse-sugar.

This ecosystem provides habitat for a variety of game species (eastern wild turkey, white-tail deer squirrels and, furbearers) and non-game species (eastern wood thrush and northern parula warbler).

Oak-dominated and mesic hardwood forests are relatively uncommon on the Francis Marion Landscape (2.2 percent of the total forested acres) and are not considered a fire adapted

ecosystem. They occur in areas that are naturally sheltered from frequent prescribed fire, as determined by interactions of local topography and soil texture. Historic fire return intervals for the Oak Forest and Mesic hardwood ecosystem range from 2-35 years with a forest plan desired return interval of eight years. Generally, this ecosystem has a closed canopy with hardwood leaf litter as the primary fuel carrier. Fuel moistures are generally higher than those in adjacent pine stands due to shading, topography and soil. Effects of low intensity prescribed fire as described in the Francis Marion Land Management Plan will have little to no effects to wildlife habitat in this ecosystem. Prescribed fire intensity when entering these ecosystems from adjacent pine stands will likely be reduced due to increased fuel moistures of the hardwood leaf litter.

Narrow Forested Swamps and Blackwater Stream Floodplain Forest:

Narrow forested swamps are areas of saturated soils generally due to low relief, poor soil drainage and a seasonally high-water table. Hydrology is dominated by rainfall and sheetflow; overbank flooding, tidal flooding and seepage are a secondary influence, if at all. Blackwater stream floodplain forests occur along small streams and rivers and include imbedded riparian areas and riparian management zones. These corridors weave throughout the entire landscape with the potential extent of approximately 26,100 acres within Management Area 1. In these ecosystems, aquatic species and community biological diversity, density and distribution are maintained, enhanced or restored. The amount, distribution and characteristics of aquatic habitats for all life stages are present to maintain populations of native species.

This ecosystem can occur as a fire-generated patch mosaic in which the various patch dominants are a variable combination of tupelo, pond pine, red maple and, most frequently, pond cypress, but sometimes bald cypress. The original vegetation constituted a true shifting mosaic. Less wet sites have canopies of wetland oaks such as laurel oak, swamp chestnut oak and cherrybark oak. Most communities have a well-developed shrub layer that has more floristic affinities with pocosins or baygalls than with river floodplain communities that have similar canopies. The shrub layer is usually dominated by summersweet, fetterbush, Coastal sweet pepperbush, or species shared with pocosins. The herb layer is not usually well-developed but may be dense where shrubs are atypically sparse. Wetland ferns, such as royal and netted chain, and sedges usually dominate.

Blackwater stream floodplain vegetation consists largely of forests dominated by wetland trees. The lowest, wettest areas have some combination of bald cypress, pond cypress, or tupelo. Higher portions of the floodplain have forests with combinations of a small set of wetland oaks and other species including loblolly pine. The wettest forests are sometimes simple in structure, with an understory but little shrub or herb layer, but the other communities tend to have well-developed understories, shrub and herb layers. Woody vines are usually prominent.

Fire is more important here than in larger river systems because distances to uplands are short and stream channels and sloughs are smaller and less effective as firebreaks. Some of these areas apparently were once canebrakes, presumably maintained by periodic fire. Because of their relatively narrow nature on the landscape, natural fire may burn into them but seldom through them, except during times of drought. Natural fire regimes vary in this ecosystem group (1-25 years), are less frequent than in uplands and are most common at the ecotones with longleaf pine ecosystems. The greatest potential for prescribed fire to effect these systems is along the ecotone between the uplands and the wetter portions. Prescribed fire operations will occur when weather and fuel conditions are appropriate, and thus the likelihood of negative effects will be mitigated. Most prescribed fire will consist of a backing or flanking fire that will impact the ecotone and

then fire intensity will significantly lessen once it begins to enter the floodplain. Fire plays a critical role in maintaining the botanical diversity within the ecotone between upland and floodplain, and thus should be applied judiciously and at the appropriate return interval.

Broad Forested Swamps and Large River Flood Plain Forest Ecosystem:

These are forested wetland ecosystems which can occupy large, seasonally inundated basins with peaty substrates, or lower reaches of river floodplains and along estuary shorelines, in places regularly or irregularly flooded by lunar or wind tides. Examples of these ecosystems are generally forested with stands of baldcypress and tupelo, bottomland hardwood species and other trees tolerant of flooding. Although most examples of this system may be thought of as acidic, some flow through regions with sufficient calcareous influence to effect vegetation composition.

In these areas, aquatic species and community biological diversity, density and distribution are maintained, enhanced or restored. The amount, distribution and characteristics of aquatic habitats for all life stages are present to maintain populations of native species. These areas include embedded riparian areas and riparian management zones.

Trees dominating stands are wetland associates such as green ash, baldcypress and tupelo and can include box elder, red maple, river birch, water hickory, sugarberry, sweetgum, cottonwood, loblolly pine and various bottomland oaks including cherrybark oak, swamp chestnut oak and Shumard's oak. Lower strata of large river floodplains are generally denser and more species rich than those of river or non-riverine swamps, containing species from those systems as well as a variety of shrubs and herbs shared with freshwater marshes. Characteristic shrubs may include buckwheat-tree, titi, wax myrtle, native swamp rose and fetterbush. Some examples may have extensive open herbaceous areas dominated by various grasses, ferns, sedges and aquatic plants.

Broad forested swamps and floodplain forests are common on the forest (approximately 19 percent or 49,300 forested acres) and are not considered a fire adapted ecosystem. Of these acres 23,000 acres occur in management area 1 with the remaining 26,000 acres occurring in MA2. Large river floodplains associated with this group include the Santee River corridor, which is linear in nature. Old growth Broad Forested Swamps and Large River Floodplain Forests provide travel corridors for wildlife and have a higher prevalence of open water, snags, downed trees and canopy gaps, providing habitat and cover for black bear, American swallow-tailed kite, wood duck, Southeastern myotis, Eastern woodrat and big-eared bat.

Historical fire return intervals in this ecosystem are from 1-218 years with a desired fire return interval of 21 years. Generally, this ecosystem has fairly high fuel moistures and are not conducive to burning. Low intensity fire entering the Broad Forested Swamps and Large River Flood Plain Forest Ecosystem from adjacent uplands would likely reduce further in intensity causing minimal to no effects to wildlife habitat within the ecosystem.

Maritime Forest and Salt Marsh:

Given their relatively rarity on the forest (3,978 acres or 1.5 percent of forested acres), their associated shell mounds, marine and estuarine systems, and function as migratory pathways for migrant birds, maritime forests and salt marsh are some of the most valuable ecosystems on the coastal fringe of the national forest. Maintaining, improving or restoring these ecosystems is a priority. These ecosystems are influenced by salt spray, extreme disturbance events, and the distinctive climate of the immediate coast. The primary disturbance for salt marsh is frequent tidal flooding with salt or brackish waters. Storms can bring seawater to brackish areas, acting as

a disturbance to vegetation. Where salt marshes are connected to the mainland, occasional fires are possible, but most salt marshes are too wet to burn. Maritime Forests are relatively stable but are adversely impacted by extreme salt spray and destruction of dunes by storms but can also colonize areas created by sand redistribution.

Natural fire in these systems is infrequent with a 2 to 52-year fire return interval. Wind, weather and salt spray are dominant influences on these systems. Maritime forest and salt marsh are not considered a fire-adapted ecosystems and prescribed fire will have minimal effects. See OBJ-ECO-6. Oak, Mesic Hardwood, and Maritime Forests and Standard S41 in the Forest Plan. Species associated with these systems include wood stork, painted buntings, American alligator, marsh rabbit, seaside sparrow, and osprey. Given the relatively long fire return interval and low intensity fuels, it is not anticipated that prescribed fire will have significant effects on these ecosystems.

Comparison of Alternatives

The major difference in Alternative 1 (Proposed Action) vs Alternative 2 is that prescribed burning acreage in Management Area 2 may increase under Alternative 1. The lack of fire in Management Area 2 since Hurricane Hugo has created low quality habitat that has heavy fuel loading. Much of Management Area 2 consist of fire-adapted ecosystems including upland pine woodlands, wet pine savannas, depressional wetlands, and Carolina Bays. These systems require frequent fire (1 – 6 years) in order to maintain biological diversity and the necessary structure to provide high quality habitat. The introduction of fire into Management Area 2, as proposed under Alternative 1, would over time provide more high-quality habitat across the landscape. Conversely, Alternative 2 would maintain the status quo and habitat within Management Area 2 would continue in its current state as fuel loadings steadily increased. In order to maintain and restore ecosystems across the landscape Alternative 1 provides the greatest potential for success.

Alternative 3 (Modified Proposed Action) is basically the same as Alternative 1, however it proposes direct ignition of prescribed fire in three wilderness areas:

- Little Wambaw Swamp Wilderness- Portions of this wilderness is classified as Wet Pine Savanna and Flatwoods ecosystem. Prescribed fire ignition should be limited to this ecosystem. Given the generally wet conditions that persist across the wilderness, the effect to habitat would be relatively low.
- Hellhole Bay Wilderness- This wilderness falls under the Broad Forested Swamps and Large River Floodplain Forests ecosystem. Natural fire regimes vary in this ecosystem, but tend to be infrequent and are most common at the ecotones with longleaf pine ecosystems (USDA 2017). The average fire return interval in these systems is 21 years, and it is not anticipated that fire would affect habitat substantially.
- Wambaw Swamp Wilderness- Alternative 3 proposes to continue burning the longleaf ecosystems within this wilderness. Low intensity prescribed fire as described in the Forest Plan should have little to no effects on the mesic portions of the wilderness.

Cumulative Impacts

The cumulative impacts of the proposed action, current management and the modified proposed action when considered with past, present and foreseeable actions, provides habitats for wildlife. Timber sales are evaluated for effects to the ecosystems and SCC. Prescribed fire activities on other ownerships creates migration corridors that allow for the movement of wildlife species across the Francis Marion.

As this project and other projects that are ongoing or proposed on the Francis Marion would comply with applicable forest plan standards, this project would not result in significant adverse cumulative effects to wildlife habitats.

Issue 2: Prescribed fire in the Francis Marion may cause Smoke management concerns.

Affected Environment

The primary legal foundation of air quality regulation in the United States is the Federal Clean Air Act. The Clean Air Act (CAA) provides the Environmental Protection Agency (EPA) with broad authority to regulate emissions from a variety of air pollution sources in the United States. Although the CAA is a federal law and therefore applies to the entire country, individual states do much of the work of implementation.

The Clean Air Act charges the U. S. Forest Service as a Federal Land Manager of Class I areas, to protect air quality related values in these areas which are wilderness areas in existence as of August 7, 1977 larger than 5,000 acres. In addition, the Clean Air Act sets standards for air quality to protect public health and welfare. The Forest Service must ensure that its activities, or activities it permits, comply with these national standards and any State and local requirements for air pollution control. States develop State Implementation Plans (SIPs) describing how they will implement the requirements of the Clean Air Act.

The National Ambient Air Quality Standards (NAAQS), are set by authority of the CAA and cover six "criteria" common airborne pollutants: They are lead, sulfur dioxide, carbon monoxide, nitrogen oxides, ozone and particulate matter. The lead and sulfur content of forest fuels is negligible, so these two forms of air pollution are not a consideration in forest fires. Air pollution can come from local sources – such as activities within the National Forests – or may be transported from distant sources by weather patterns. Therefore, it is important to identify the airshed around an area of interest, such as the Francis Marion National Forest. An airshed is defined as a geographic area that, due to topography, meteorology and/or climate, is frequently affected by the same air mass.

For the purposes of this assessment, the airshed for the Francis Marion National Forest is defined as the counties that fall within a 200-kilometer radius around the Forest in order to select the most sensitive areas. A map of the airshed is shown in Figure 2-1. The map shows the counties located within 200 km of the Forest (shaded) as well as known sensitive air quality areas. These sensitive areas include the location of Class I and Nonattainment areas (Charlotte-Rock Hill) within the designated airshed. As shown in Figure 2-1, the only Class I area located within the project airshed is Cape Romain National Wildlife Refuge, located just to the east of the Francis Marion National Forest. There is one nonattainment area partially located within the airshed, the Charlotte-Rock Hill Nonattainment Area for ozone. There are no other nonattainment or Class I areas within the airshed.

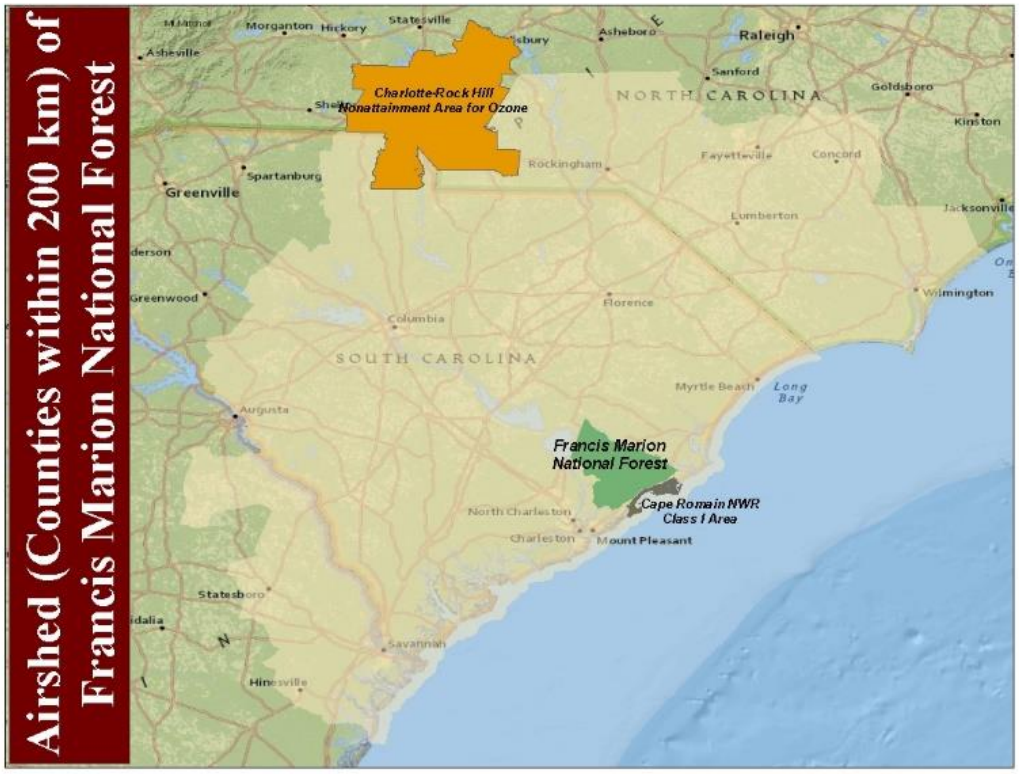


Figure 2-1: Map of Francis Marion National Forest Airshed and Known Sensitive Air Quality Areas

Requirements set forth in the CAA, as administered by the South Carolina Department of Health and Environmental Control (DHEC) Office of Environmental Quality Control Bureau of Air Quality, for the maintenance of the National Ambient Air Quality Standards (NAAQS) and associated Regional Haze Rule mandate protection of public health and human welfare (e.g. forest health). They set the legal foundation that guides the Forest Service in protecting air quality during prescribed fire activities. Criteria set forth in the Forest Service Region 8's Smoke Management Guidelines (see Appendix C) provide the methodologies which are used to protect air quality during project implementation.

This report provides the indicators utilized to compare potential impacts to the key NAAQS. These are measured levels of these air pollutants indicating the current condition and trends associated with all activities generating these key pollutants within the airshed. The criteria pollutants of most concern from prescribed burning on the Francis Marion National Forest are particulate matter and ozone. Levels of these pollutants are measured at air monitoring sites near the National Forest. Fine particulate matter is the leading cause of regional haze (also known as visibility impairment), while ozone can harm sensitive vegetation within the forest. Additionally, at elevated concentrations these two pollutants can impair the health of both employees and visitors to the National Forest.

Particulate Matter

Particulate matter is a mixture of extremely small particles made up of soil, dust, organic chemicals, metals, and sulfate and nitrate acids. The size of the particles is directly linked to health effects, with smaller particles causing the worst impacts to human health. As a result, EPA has set a primary NAAQS for ultra-small (less than 2.5 microns in diameter) particulate matter on

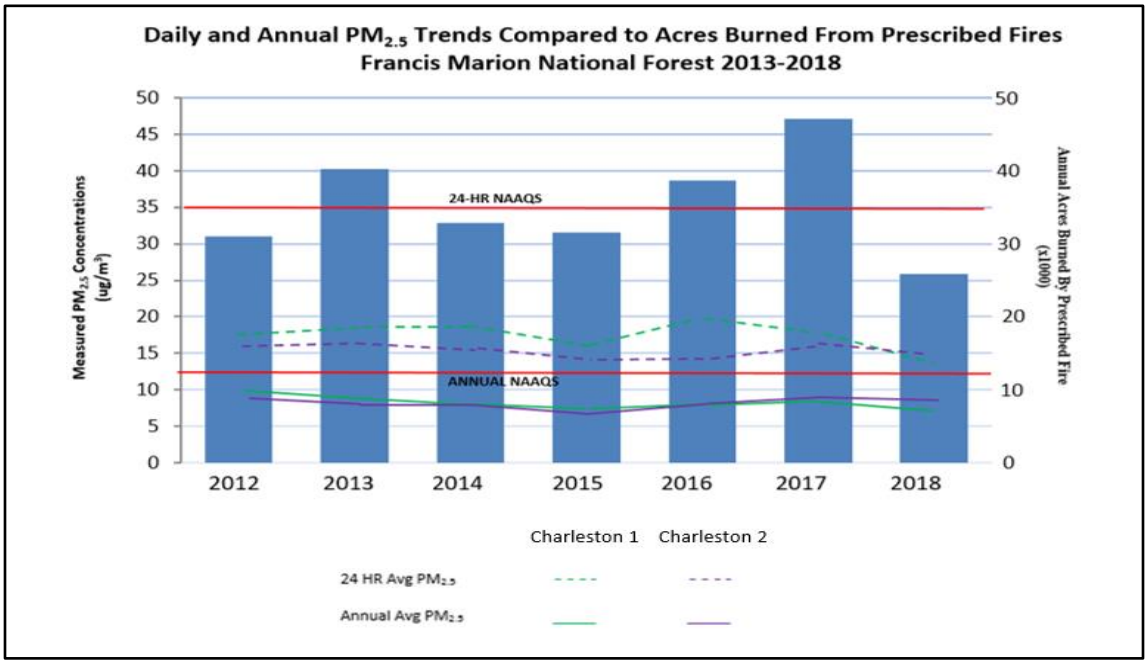
both a short-term (24-hour) and annual basis. The 24-hour fine particulate matter ($PM_{2.5}$) NAAQS is currently set at 35 µg/m^3, while the annual $PM_{2.5}$ NAAQS is 12 µg/m^3. The graphics below show the measured $PM_{2.5}$ levels at the two fine particulate matter monitoring sites located near the Francis Marion National Forest (Figure 2).

The South Carolina Department of Health and Environment Control (DHEC) operates fine particulate matter monitoring sites throughout the state, including several near the Francis Marion National Forest. The closest two monitors are located near Charleston, SC at Chareston County #1: 32.980054° -80.064799 and Charleston County #2: 32.791004° -79.958672°, appoximately 12 miles W and SW of Francis Marion Boundary, respectively.

The maximum measured values and trends at the above monitoring sites as compared to both the daily and annual $PM_{2.5}$ NAAQS are shown in the graphs below. (Data Source: http://www.epa.gov/airdata/ad_rep_mon.html). The blue columns are measured annual averages, and the green columns are measured daily values; the annual and daily NAAQS thresholds are shown by the two red lines.

As shown below, measured particulate matter pollution near the national forest are not exceeding either the 24-hour or the annual $PM_{2.5}$ standard; and are within target and warrant no change (Figure 2-2).

Figure2- 2. Particulate Matter (PM2.5) Trends near Francis Marion National Forest as Compared to acres burned/prescribed fires on the Francis Marion National Forest (Data Source: http://www.epa.gov/airdata/ad_rep_mon.html)



Particulate Matter as it applies to Visibility Impairment

In addition, PM2.5 is the major contributor to visibility impairment. The Cape Romain IMPROVE monitor has monitored various PM types since 1995, and a significant trend has been maintained over that period of improving visibility conditions, as shown in Figures 2-3, 2-4, and 2-5 below.

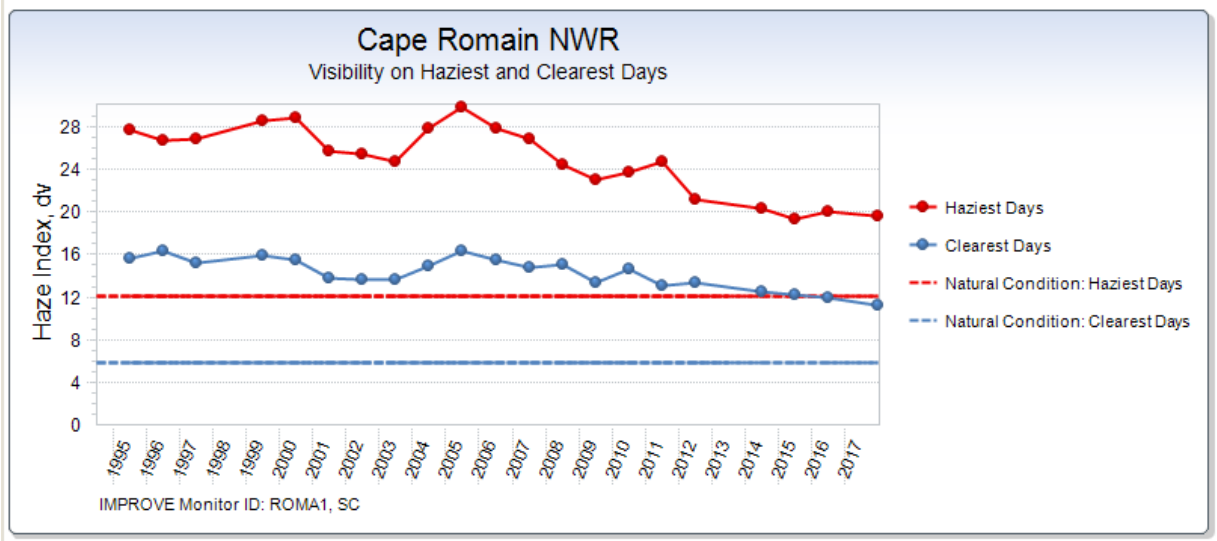


Figure 2-3. Visibility Improvement Over Time at the Cape Romain National Wildlife Refuge (Source: https://views.cira.colostate.edu/fed/SiteBrowser/Default.aspx?appkey=SBCF_VisSum, 6/28/2019)

Ozone

It cannot definitively be said whether or not prescribed fire affects ozone levels. But conservatively, if burning is limited to those times that the Air Quality Index (AQI) for ozone is or is predicted to be Good (green) or Moderate (yellow) (as indicated at the following site: https://www.airnow.gov, as elsewhere in this document), ozone levels will not be affected. Exposure to elevated ozone levels can cause human health concerns as well as negative impacts to vegetation. As with fine particulate matter, a national air quality standard for protection of both public health and the environment has been set for ground level ozone. The current ozone NAAQS is set at 0.070 ppm.

There are two monitoring locations that measure ozone concentrations near the Francis Marion National Forest: Berkeley and Charleston County; South Carolina.

The following graph show the ozone concentrations at the monitors near the forest for the years 2013-2018, calculated in the same form as the NAAQS (3-year average of the 4th highest 8-hour ozone concentration). The NAAQS threshold is shown below as the red line. Note all of the most recent 3-year averages are below the NAAQS; and are within target and warrant no change (Figure 2-4).

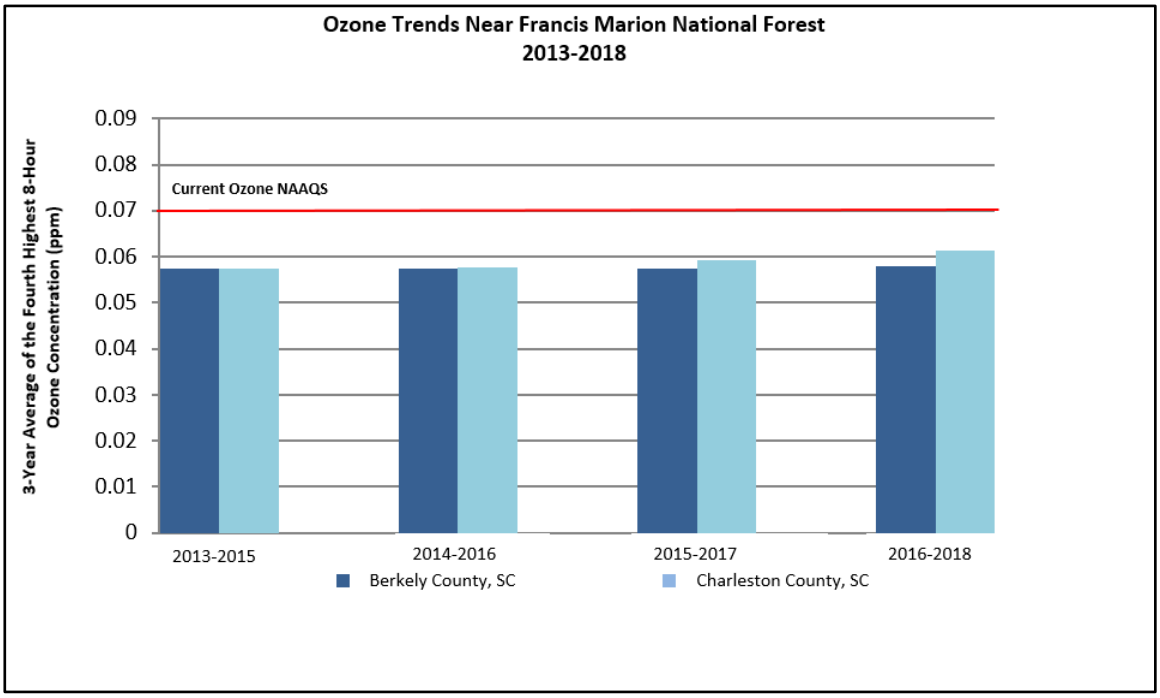


Figure 2-4. Ozone concentrations measured near Francis Marion National Forest (Data Source: http://www.epa.gov/airdata/ad_rep_mon.html)

Air Quality standards in Prescribed Fire Planning.

Prior to implementing prescribed burns, Forest Service staff check the current and forecasted Air Quality Index (AQI) at the following site: https://www.airnow.gov. The Forest Service will not burn under a wind direction that would transport smoke into an area that is forecast to be at the AQI code (Unhealthy for Sensitive Groups (orange), Unhealthy (red), or (Very Unhealthy (purple) on the day or evening of the burn.

Burn plans are prepared to ensure smoke management objectives meet agency policy and that prescribed fires will not contribute to or cause an exceedance of a National Ambient Air Quality Standard (NAAQS). Prescribed burn planning will include the appropriate analysis procedures as directed in the South Carolina State Smoke Management Guidelines. The South Carolina Forestry Commission is responsible for administering the State Management Guidelines and in doing so consults and coordinates activities with the National Weather Service and South Carolina Department of Health and Environmental Control (DHEC).

Cape Romain National Wildlife Refuge is located adjacent to the Francis Marion in places along the coast and is a Class I area and is monitored for regional haze. The regional haze regulations require states to establish long-term strategies for reducing emissions of air pollutants that cause visibility impairment in Class I areas. Prescribed fire is a temporary air pollution source that can be scheduled during optimum meteorological conditions or at times of the year when air pollution concentrations are less likely to exceed standards. Extra planning, documentation, and careful scheduling of prescribed fires will likely be required in an effort to minimize smoke in the non-attainment area,to the greatest extent possible. By making a case to the air regulatory agency that burning will not cause or add to air quality standard violations, prescribed fire managers may be able to implement prescribed burns in non-attainment areas with little to no restrictions.

Methodology

Spatial Scale (direct, indirect, and cumulative effects analysis areas)

Air quality will be impacted on the forest, adjacent private lands and public roadways to the greatest extent downwind of the location of the prescribed burn. Figure 2-5 below shows areas where smoke can travel off forest and away from the burn location (dark green) with direct impacts within two miles of the burn. Light green on the map indicates the forest boundary and smoke may have impacts anywhere burning takes place on forest lands.

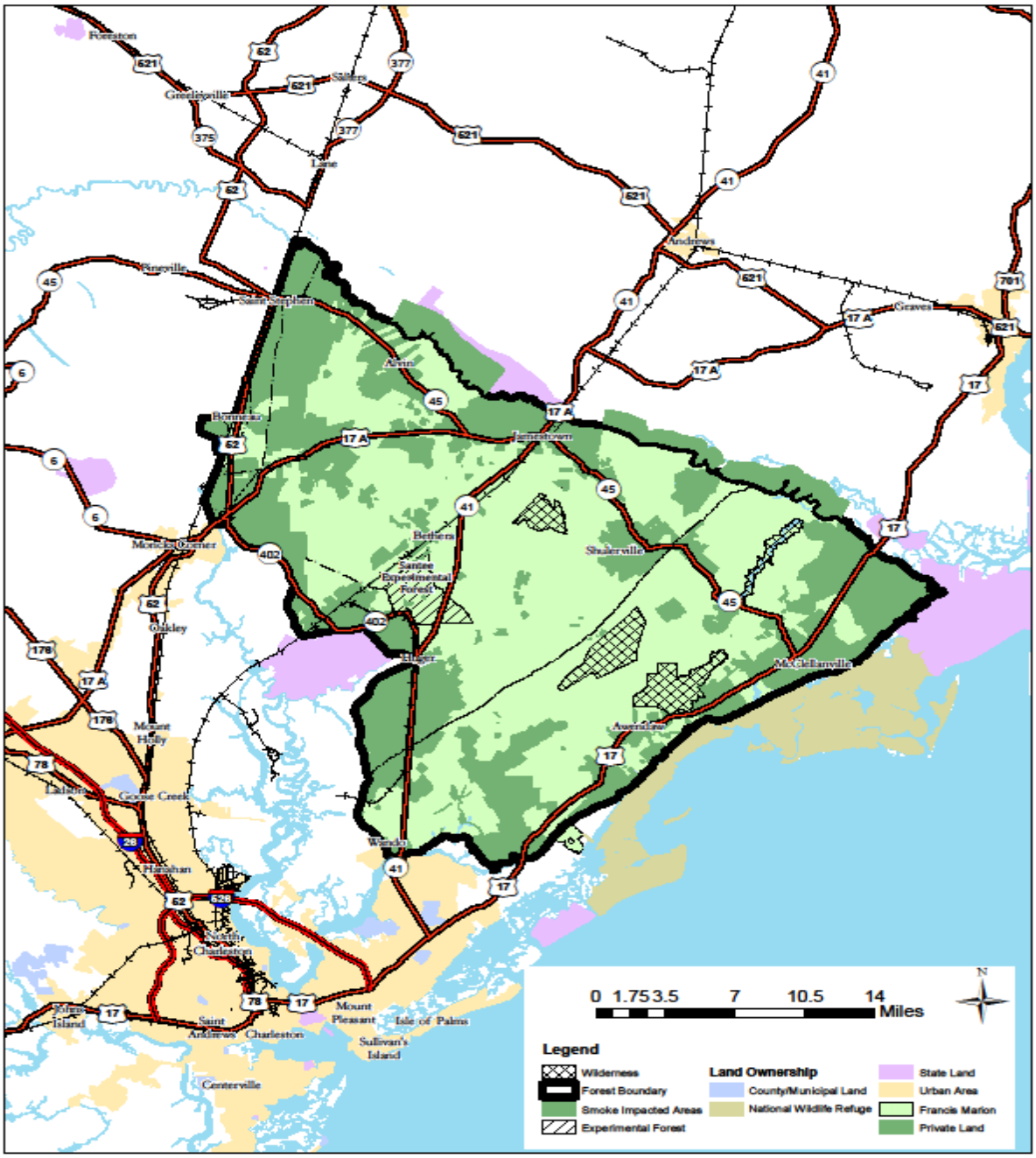


Figure 2-5. Area of potential smoke impacts

Direct emissions may travel up to 2 miles from the burn location creating a nuisance with possible ash fallout and smoke odors. During project planning smoke will be directed away from known sensitive targets that may be affected the most from smoke emissions or the smoke may be dispersed to sufficiently low fine particle concentrations that it will not cause an adverse impact to visibility or public health.

For some locations, even the most diligent planning will provide no option that can avoid all smoke sensitive targets. In those cases, the plan can be modified, or the Francis Marion will contact the resident/owner to see if the impact from the smoke can be mitigated. Plans will use the latest tools and weather forecasts to safeguard against smoke impacts as much as possible, local knowledge and expertise can provide insight for plans that require special weather conditions for implementation.

Cumulative effects on air quality which historically last 2-6 hours can be large visual impacts of smoke rising and causing some temporary shading that may cause concern with downwind residents. Smoke can also create a nuisance and can generate numerous complaints from the public. For example, ash fallout can soil personal property, people may complain about the odors from the smoke, and/or suffer eye and nose irritation from the acrolein (and possibly formaldehyde) found in the smoke.

Ground level smoke does not have enough heat to rise into the atmosphere. It stays in intermittent contact with the human environment and turbulent surface winds move it erratically. Also in comparison to smoke aloft, human exposure is more intense, relatively brief (a few hours) and limited to a smaller area. Smoke aloft is already dispersed before it returns to the human environment while ground level smoke must dissipate within that environment. Ground level smoke is dissipated through dispersion and deposition of smoke particles on vegetation, soil and other objects.

Indirect effects can be from a large smoke column that may be seen in atmosphere and may have the public concerned of a wildfire. Smoke on public roads may require temporary closures resulting in traffic delays or re-routes.

Temporal Scale (The length of time effects are considered for impacts)

Historically prescribed burns on the Francis Marion take the better part of the day to complete. Ignitions can last up to seven hours pending conditions and locations on the forest. Fuel loading and weather conditions will influence the length of time that residual smoke will stay in the area. Units that are burned on a regular rotation will emit much less smoke, typically for no more than 24 hours. Units that have not been treated in a regular rotation may see residual smoke lasting several days.

Prescribed fire emissions normally affect air quality on a short-term intermittent basis but with exposure to a large area, (Approximately a mile in circumference). The amount of smoke and how it is dispersed depends on the size of the burn, the fuel loading, and the meteorological conditions at the time of the burn. In general, smoke from prescribed burning disperses into the atmosphere and combines with other existing pollutants. The wind transports the smoke/pollutants to areas many miles away where they are added to and possibly react with other gases/pollutants present in the atmosphere. Most (about 75%) of the emissions are "lifted" by convection into the atmosphere where they are dissipated by horizontal and downward dispersion from the fire. The balance of the emissions (about 25%) remains in intermittent contact with the

ground and the impact on air quality is dissipated by dispersion, surface wind turbulence and particle deposition on vegetation and the ground.

Typically, during the evening and/or nighttime the air mixing height reduces, the atmosphere becomes stable, relative humidity increases, and the surface wind speeds decrease to very low levels.

During these periods, the smoldering emissions are likely to be trapped near the ground and slowly transported from the burned area. The smoke will follow the drainages and collect in low lying areas. Ground level smoke does not have enough heat to rise into the atmosphere. It stays in intermittent contact with the human environment and turbulent surface winds move it erratically. Ground level smoke is dissipated through dispersion and deposition of smoke particles on vegetation, soil and other objects.

Direct and Indirect Effects

Emissions from prescribed burning will affect the air resource within and outside of the project boundaries on any given burn. A combination of factors determine the amount of emissions that will be released into the atmosphere and the subsequent effects it will have to the surrounding environment. Prescribed burning would emit concentrations of gases, water vapor, and particulate matter that may impair human health, welfare, and visibility. During prescribed burns these gases and particulate matter are quickly diluted, low in concentration or intermittent in occurrence and therefore public health hazards are negligible.

The primary concern to implementing prescribed burns on the forest are the impacts to sensitive areas such as adjacent residents and impacts to local roads. State smoke guidelines and Forest Service requirements for prescribed burning limit the adverse effects from emissions by using a State permit system that is associated to a dispersion index which calculates the ventilation rates and distance to known sensitive impacts areas. These guidelines l reduce burnable acres thus reducing impacts of smoke to the general area. Prescribed burning on the Francis Marion does not contribute to an exceedance of state recorded levels of particulate matter. See Table 2-6.

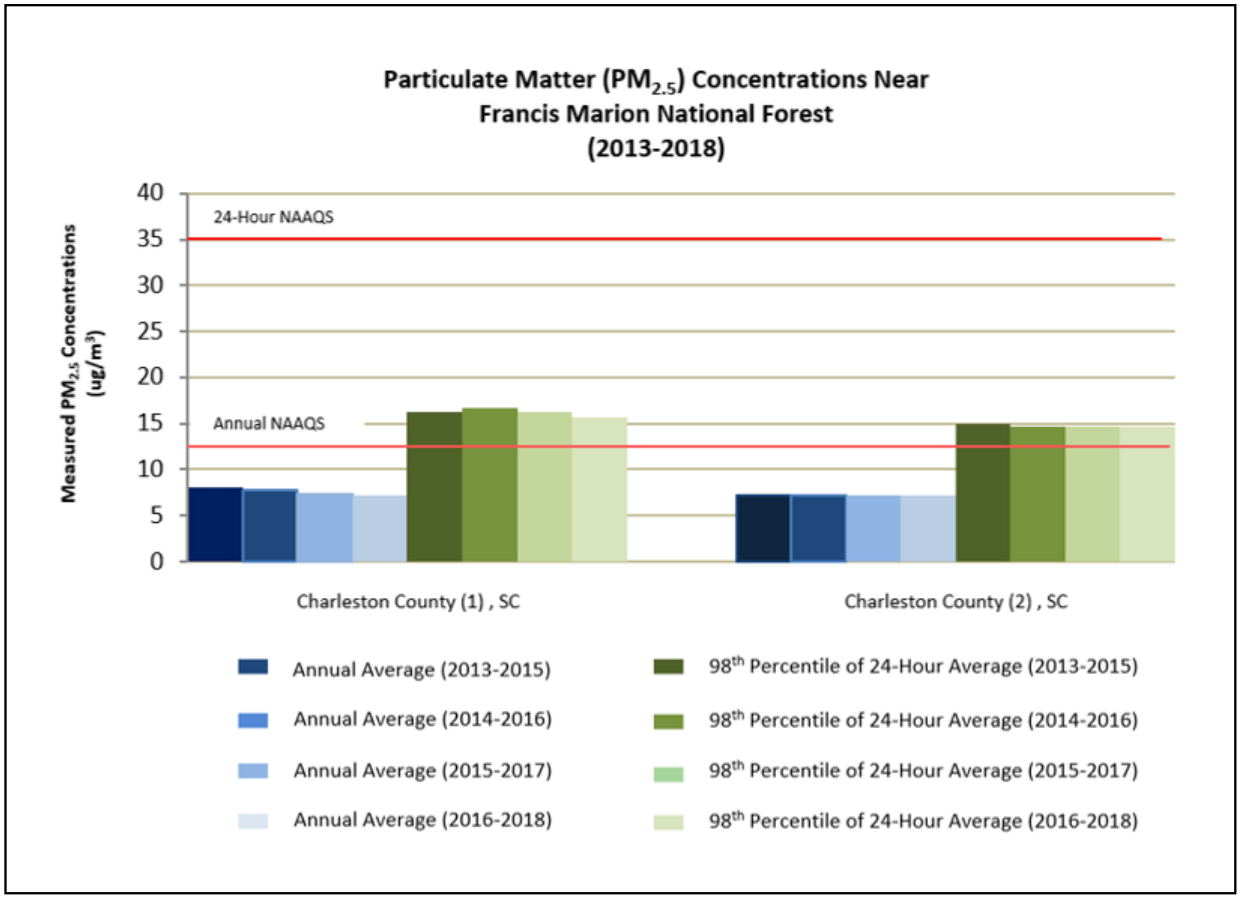
Prescribed fires are ignited when weather conditions allow fire to burn in a controlled manner to achieve desired effects. Proper weather conditions allow for smoke dispersal and effective burning. Wind, humidity, air temperature, rainfall and state guidelines are all considered. Weather conditions can fluctuate on an hourly basis, so fire managers consistently monitor weather to ensure that we are meeting the objectives in the burn plans.

All three alternatives would provide increased opportunities for Federal, State and private partners to work together while creating fire-adapted human communities. By working with partners and homeowners to reduce hazardous fuels, the likelihood that a wildfire burning in adjoining vegetation would ignite homes or other structures can be mitigated and reduce potential smoke emissions.

Due to a successful history of prescribed fire in MA1 of the Francis Marion, significant portions of the national forest are in fire regime condition classes 1 and 2, which have fewer smoke emissions due to the implementation of repeated prescribed fire. Current management (Alternative 2) carries and creates the greatest risk of smoke emissions. Without reducing hazardous fuel buildup, once ignited and burned under wildfire, these fuels would produce levels of emissions far exceeding those output under planned ignition events. By not treating the build-up of hazardous fuels within fire-dependent ecosystems in the wildland-urban interface, these

systems would continue to display uncharacteristic fire intensity and fire severity characteristics. These uncharacteristic fire intensities would be more difficult to react to, suppress, and predict ultimately releasing more smoke emissions than a planned event.

Table 2-6. Particulate Matter ($PM_{2.5}$) Concentrations near Francis Marion National Forest



The proposed action (Alternative 1) and modified proposed action (Alternative 3) would provide the greatest opportunity to reduce the threat and risks associated with wildland fire. The proposed action (Alternative 1) and the modified proposed action (alternative 3) would increase the area burned and the return interval frequency in the growing season. However, the proposed action and modified proposed action could see increased impacts of smoke production and associated impacts from planned ignitions within MA2 in the short-term. Smoke output from maintenance prescribed burning releases less particulate matter than a prescribed burn in an area that has not been burned in several years or from a wildfire. The emissions from a first entry prescribed burn are less than an unplanned wildfire.

As repeated prescribed fire is implemented, a grass- and forb-dominated understory would prevail over a larger part of the landscape. In this condition, surface fuels are the primary component contributing to fire behavior. There would not be as much of a woody live and dead fuels component to contribute to either flaming or smoldering fire behavior. Suppression efforts would be less costly while providing a higher degree of safety to both the public and firefighters.

Together, these data points (Tables 2.2 to 2.4, Table 2.6) indicate that smoke generated from ongoing prescribed fire activities including and since 2013 have not violated the key NAAQS within the airshed of the Francis Marion National Forest or led to unacceptable visibility impairment. **All alternatives should exhibit the same effects**, as long as the Region 8 Smoke Management Guidelines are followed during prescribed fire activities. **This will include burning within the wilderness areas of the Forest.** The effects of prescribed fires are usually short-lived and cumulative impacts are generally ascribed to impacts to potential for smoke accumulation. Prescribed fire can have short-term negative effects on air quality. These effects may be mitigated by burning at certain times of the year, at certain fuel moisture thresholds and under meteorological conditions that promote smoke dispersion. This information is provided in the burn plan prepared for each prescribed fire. A smoke management plan is required for each burn plan. (See burn plan template posted on-line). The impacts of prescribed fire on soils and air would be expected to stay within established limits for federal and state air quality standards.

Cumulative Impacts

The cumulative impacts of the proposed action, current management and the modified proposed action when considered with past, present and foreseeable actions (including timber sales and other actions) meets air quality standards and provides for smoke dispersion.

Prescribed fire activities on other ownership must meet smoke management guidelines for the State of South Carolina (https://www.state.sc.us/forest/srefsmg.htm). The South Carolina Smoke Management Guidelines, written by the SC Forestry Commission, minimizes the impact of smoke from vegetative debris burning operations for forestry, agriculture, and wildlife purposes. The Guidelines define smoke sensitive areas, amounts of vegetative debris that may be burned, and atmospheric conditions suitable for burning this debris. Daily compliance with the smoke management guidelines will be coordinated by the appropriate SC Forestry Commission Dispatch Center. Dispatchers will be thoroughly familiar with the **Smoke Management Guidelines** and the **Operating Plan for Fire Weather Service in South Carolina** and will keep informed of the category day and the respective mixing heights and transport winds. Dispatchers will maintain a record of smoke management notifications and smoke complaints.

A written prescribed fire plan, prepared by a knowledgeable person, is recommended for each forest, wildlife, and agricultural area to be burned (except for crop stubble and grass fields). The plan can be simple or complex, depending on the area, but each burn unit should be similar in topography, fuels, and the burn objective.

Compliance with the smoke management guidelines should ensure that prescribed fire operations on and off national forest land meet federal and state air quality standards.

Issue 3: Prescribed fire can have unintended effects to merchantable timber and mast-producing vegetation.

This section analyzes the effects of prescribed fire to mast producing vegetation and merchantable timber within each ecosystem identified in the FEIS for the Forest Plan. Specifically, the effects to mast production and merchantable timber are considered by the ecosystems listed in Table 3-1 below.

Affected Environment

Section 3.3 (Biological Environment, pages 101-135) of the FEIS describes the current condition for each modeled ecosystem on the Francis Marion National Forest. Section 2.2.1 (Ecosystem Maintenance and Restoration, pages 20-39) of the Forest Plan further describes the desired condition and management objectives for each ecosystem. The analysis included herein tiers to the analysis provided in the Forest Plan FEIS and incorporates the FEIS and Forest Plan by reference.

Table 3-1. Potential Ecosystems on the Francis Marion National Forest

Potential Ecosystems on the Francis Marion	Administrative Boundary (acres)
Upland Longleaf and Loblolly Pine Woodlands and Forests	51,500
Wet Pine Savannas and Flatwoods	86,200
Depressional Wetlands and Carolina Bays	8,700
Pocosins	9,200
Narrow Forested Swamps and Blackwater Stream Floodplain Forests	44,200
Broad Forested Swamps and Large River Floodplain Forests	49,200
Oak Forests and Mesic Hardwood Forests	5,800
Maritime Forests and Salt Marsh	4,000
Total	**259,300**

Environmental Effects

Upland Longleaf and Loblolly Pine Woodlands

Frequent, low-intensity fire is the dominant natural ecological force in the upland longleaf pine ecosystem. Frequent fire typically leaves woodland or savannas dominated by longleaf pine or less frequently by loblolly pine, or some combination. Ground cover is often dominated in a well-developed grass-herb layer. However, on drier sites, understories may be dominated in scrub oak species such as runner oak, blackjack oak, bluejack oak, or turkey oak. Low intensity fires typically burn above-ground parts of herbs and shrubs but have little effect on the fire-tolerant trees. Vegetation recovers very quickly from fire, with live herbaceous biomass often restored in just a few weeks. In the absence of fire, less fire-tolerant species increase and invade the system. Scrub oaks and shrubs, kept to low density and mostly reduced to shrub size by fire, become tall and dense and can suppress longleaf regeneration. Herb layer density and diversity decline (NatureServe 2009).

The historic fire return interval for this ecosystem is 1-3 years with a desired return interval of 2 years. Frequent fire ensures longleaf pine is the most common and dominant tree species but an understory of scrub oak is common. Frequent fire typically limits canopy and midstory mast producers to ecotones where fire intensity and occurrence is often less than the surrounding uplands. Understory shrubs, including dwarf and black huckleberry, dangleberry and deerberry provide soft mast (USDA 2017). This ecosystem is suitable for timber production and prescribed burning has the potential to incur economic loss. In fact, the Francis Marion includes midstory reduction objectives within their burn plans. The burn plans define midstory as any woody stem (including tall shrubs, trees and vines) greater than 10 feet tall and up to the height of the bottom of the tree canopy. This could include some low value merchantable pole timber within older stands. If conditions are wrong, prescribed burning can severely damage timber stands. First entry burns have the greatest potential for significant timber mortality due to fuel loading and require specific weather conditions and firing techniques to minimize fire damage. Once fuel is reduced from the first entry, weather parameters for subsequent prescribed burns will not be as tight. (USDA 1989). With such a large and complex landscape, some merchantable timber loss is to be expected even when burning under ideal conditions and using appropriate firing techniques. However, low intensity prescribed burning as described in the Forest Plan requires burn plans, resource integration, specific weather parameters, and firing techniques that should minimize economic loss. In fact, low intensity prescribed burning should reduce the risk of wildfires that often occur outside of prescribed burning weather parameters that can lead to significant loss of merchantable timber.

Frequent, low-intensity fire is also the dominant natural ecological force in the wet pine savanna and flatwood ecosystem. Frequent fire typically leaves woodland or savannas dominated by longleaf pine or less frequently by loblolly pine, pond pine, or some combination. Hardwoods are present in any abundance only in examples altered by fire suppression. The ground cover is a dense combination of herbs, grasses, and low shrubs. Frequent fire is the predominant natural force in this system and is crucial in determining its structure and even its identity. Low intensity fires typically burn above-ground parts of herbs and shrubs but have little effect on the fire-tolerant trees. Vegetation recovers very quickly from fire, with live herbaceous biomass often restored in just a few weeks. In the absence of fire, the shrubs increase and hardwoods may invade the system. Herb layer density and diversity decline after just a couple of years without fire (NatureServe 2009).

The historic fire return interval for this ecosystem is 1-3 years with a desired return interval of 2 years (USDA 2017). Frequent fire typically limits mast producers to ecotones. Inkberry is a common soft mast producer in the understory. This ecosystem is suitable for timber production with expected fire effects to merchantable timber similar to that described above in the upland longleaf pine ecosystem.

Depressional Wetlands and Carolina Bays

Depressional wetlands and Carolina bays are palustrine wetlands, which contain a variety of vegetation types depending on fire regime and flooding depth and duration. Variation in flooding is the most important dynamic, however fire is also an important process spreading into the wetlands from adjacent uplands when conditions are dry. Vegetation in Carolina bays and depressional wetlands can range from pond cypress to swamp tupelo, to pond cypress savannas, and non-alluvial swamps. Frequent fire is an important process for maintaining and restoring the herbaceous component within Carolina bays and depression ponds and their ecotones. Numerous depressional wetlands and Carolina bays are imbedded within the longleaf pine ecosystem where

fire would have occurred frequently, burning into the ecotones and often through the entire area. Where fire is removed, loblolly pine often invades the area (USDA 2017).

The historic fire return interval for this ecosystem is 1-6 years with a desired return interval of 3 years (USDA 2017). Mast producers are typically limited to ecotones where frequent fire may reduce them overtime in favor of herbaceous vegetation. Low tree densities are desired in this ecosystem and frequent fire would maintain lower tree densities. This ecosystem is typically not suitable for timber production; therefore prescribed fire would not have a significant impact on merchantable timber in this ecosystem type.

Pocosin

Pocosins are wetlands with organic soils occurring on broad flats or gentle basins. Vegetation is predominantly dense evergreen shrubland, to shrubby woodlands, ranging to nearly closed forests. The most common tree in this ecosystem is pond pine. Other embedded plant communities include native canebrakes and seepage swamp, pocosin and baygall ecosystems. Fire and flooding are the most important processes influencing the composition of these systems (USDA 2017). Fires can be intense due to density and flammability of the vegetation, typically killing all above-ground vegetation. They are followed by vigorous root sprouting by shrubs and hardwoods, leading to recovery of standing biomass within a few years. Pond pine recovers by epicormic sprouting or by regeneration from seed released from serotinous cones. (NatureServe 2009).

Natural fire-return intervals are not well known, but are probably on the order of a decade or two in the wettest areas. Peripheral areas may be subject to fire as often as the surrounding vegetation burns, which may naturally have been an average of 3 years. Due to the flammability and density of vegetation in this system, prescribed fire can be difficult to control. Although fire can be intense in this system, it typically recovers rapidly post burn (NatureServe 2009). This system is typically not suitable for timber production, however economic loss may be seen along pocosin ecotones during intense fires. This is especially true in areas of heavy fuel buildup such as in Management Area 2. Hard mast is not a common component in this system, but highbush blueberry, creeping blueberry, and bamboo-vine are soft mast producers that respond well to fire (Porcher 1995).

Oak Forests and Mesic Hardwood Forests

Oak-dominated and mesic hardwood forests typically occurred in areas that were naturally sheltered from frequent fire, as determined by interactions of local topography and soil texture. Natural succession is the dominate force in this ecosystem with infrequent natural fire regimes (USDA 2017). However roads, drainage ditches, aerial ignition, and conversion of some sites to loblolly pine have exposed some areas to frequent fire.

Due to the limited extent of these ecosystems on the Francis Marion, restoring, improving or maintaining them is a priority (USDA 2017). Low intensity prescribed fire as described in the Forest Plan would typically have little to no effect on this ecosystem. Fire intensity when entering these ecosystems from adjacent stands would likely be reduced due to increased fuel moistures of the hardwood leaf litter. The exception is where roads, drainage ditches, and conversion to loblolly pine have degraded sites exposing them to greater fire risk. It is important to identify significant areas in an effort to mitigate potential negative effects when aerially burning or igniting off roads that may expose these once sheltered areas to fire.

Narrow Forested Swamps and Blackwater Stream Floodplain Forests

Flooding and natural succession are the dominant processes in these systems, however fire is more important here than in larger river systems because distances to uplands are short and stream channels and sloughs are smaller and less effective as firebreaks. Closed canopy forests are common ranging from cypress and tupelo on the wettest sites to wetland oaks and loblolly pine on drier sites (USDA 2017).

Natural fire regimes vary in this ecosystem group (1-25 years), are less frequent than in uplands, and are most common at the ecotones with longleaf pine ecosystems (USDA 2017). Effects of low intensity prescribed fire as described in the Forest Plan will have limited effects on this ecosystem. Fire effects are typically limited to ecotones, where prescribed fire intensity in these areas from adjacent pine stands will likely be reduced due to increased fuel moistures of the hardwood leaf litter.

Broad Forested Swamps and Large River Floodplain Forests

Natural succession and flooding are the dominant processes in these systems. Tidal flooding, regular or irregular, can be an ecological factor in some of the associated systems. Trees dominating stands are wetland associates such as green ash, baldcypress and tupelo and can include: box elder, red maple, river birch, water hickory, sugarberry, sweetgum, cottonwood, loblolly pine and various bottomland oaks including cherrybark oak, swamp chestnut oak and Shumard's oak (USDA 2017).

Natural fire regimes vary in this ecosystem group, but tend to be infrequent and are most common at the ecotones with longleaf pine ecosystems (USDA 2017). Effects of low intensity prescribed fire as described in the Forest Plan will have limited effects on this ecosystem. Fire effects are typically limited to ecotones, where prescribed fire intensity in these areas from adjacent pine stands will likely be reduced due to increased fuel moistures of the hardwood leaf litter.

Maritime Forests

Wind, weather, and salt spray are the dominant influences on this system. Maritime forests include shrublands and forests. Vegetation may also include forests dominated by a small set of salt- tolerant evergreen trees, mainly live oak, upland laurel oak, loblolly pine and sabal palmetto (cabbage palm). Shrublands dominated by salt-tolerant shrubs such as wax myrtle and yaupon or by stunted trees often occur at the seaward edge (USDA 2017).

Given the relative rarity on the forest, maintaining, improving or restoring this ecosystem is a priority. Fire may have naturally occurred infrequently in this system, but most likely was not an important factor (NatureServe 2009). Low intensity prescribed fire as described in the Forest Plan would typically have little to no effect on this ecosystem. Fire intensity when entering these ecosystems from adjacent stands would likely be reduced due to increased fuel moistures of these sites. The exception is where roads, drainage ditches, and conversion to loblolly pine have degraded sites exposing them to greater fire risk. It is important to identify significant areas in an effort to mitigate potential negative effects when aerially burning or igniting off roads that may expose these areas to fire.

Comparison of Alternatives

The major difference in Alternative 1 (Proposed Action) vs Alternative 2 is that prescribed burning acreage in Management Area 2 may increase under alternative 1. Due to fuel loading issues in Management Area 2, first entry burns have the most potential for adverse timber effects requiring

exacting weather conditions to minimize fire damage. Once fuel is reduced from the first entry, weather parameters for subsequent prescribed burns will not be as tight. (USDA 1989). Therefore, merchantable timber mortality and mast production loss may be greater under Alternative 1.

Alternative 3 (Modified Proposed Action) is basically the same as Alternative 1, however it proposes direct ignition of prescribed fire in three wilderness areas:

- Little Wambaw Swamp Wilderness- Portions of this wilderness is classified as Wet Pine Savanna and Flatwoods ecosystem. Prescribed fire ignition should be limited to this ecosystem. Mast production and timber loss potential is greatest during the initial prescribed burn. However, low intensity prescribed burning as described in the Forest Plan requires burn plans, resource integration, specific weather parameters, and firing techniques that should minimize loss.
- Hellhole Bay Wilderness- This wilderness falls under the Broad Forested Swamps and Large River Floodplain Forests ecosystem. Natural fire regimes vary in this ecosystem, but tend to be infrequent and are most common at the ecotones with longleaf pine ecosystems (USDA 2017). Prescribe burning here would be difficult under normal prescribe burning parameters due to the hydric nature of the site. Burning would typically be limited to extreme fire weather conditions where fire effects could be catastrophic. Although pine occurs within the wilderness, it is important to note that loblolly pine naturally occurs within this bottomland ecosystem (USDA 2017). Prescribe burning the Hellhole Bay Wilderness would contradict the intent of the Forest Plan and could have adverse timber and mast production effects.
- Wambaw Swamp Wilderness- Alternative 3 proposes to continue burning the longleaf ecosystems within this wilderness. Low intensity prescribed fire as described in the Forest Plan should have little to no effects on mast production and merchantable timber within this wilderness.

Cumulative Impacts

Past, present and foreseeable timber harvests may reduce fuel loadings by removing wood products. Sometimes timber harvests can be planned prior to a first-entry prescribed fire to reduce fuel loadings. The cumulative impacts of the proposed action, the current management and the modified proposed action when considered with past, present and foreseeable timber sale no cumulative impacts to timber mortality are anticipated.

The greatest risk from prescribed fire activities on other ownership is that the prescribed fire might escape and impact national forest lands. Implementation of repeated prescribed fire on national forest will reduce the risk from an escaped prescribed fire. A written prescribed fire plan, prepared by a knowledgeable person, is recommended for each forest, wildlife, and agricultural area to be burned (except for crop stubble and grass fields). The plan can be simple or complex, depending on the area, but each burn unit should be similar in topography, fuels, and the burn objective. Compliance with the SC Forestry Commission's guidelines should reduce the risk of prescribed fire operations off national forest land.

Issue 4: Fire Management in Wildernesses may impact Wilderness Character

Congressionally designated wilderness areas are protected by the Wilderness Act (P.L. 88-577 (16 U.S. C. 1131-1136)) and valued for their ecological, historical, scientific, and experiential resources. Also, wilderness is valued for preserving representative natural ecosystems and local landscapes. The very existence of wilderness is valued by the American public as part of the natural heritage of the country.

The Francis Marion National Forest is home to four designated wilderness areas: Hellhole Bay (2,125 acres); Wambaw Swamp (4,815 acres); Little Wambaw Swamp (5,047 acres); and Wambaw Creek (1,825 acres). The combined acreage for all four wilderness areas is 13,812 acres. On the Francis Marion National Forest this represents about 5 percent of the total forest acreage. Annual wilderness use for both the Francis Marion and Sumter National Forests is about 11,590 visits per year, or about one percent of total visitor use.

These wildernesses give visitors a chance to see undisturbed wetlands, blackwater creeks and cypress/gum swamps, and their associated wildlife such as the alligator, prothonotary warbler, and wood duck. Due to the dense, impassable vegetation conditions, the high level of ticks and mosquitoes in the swampiest areas the recreation use in most of the areas is extremely low. Opportunities for solitude, challenge, adventure, excitement and self-reliance and risk are high. See the following pages for a more detailed description of each Wilderness.

The existing wilderness areas should maintain the areas' natural characteristics. Four qualities of wilderness help describe wilderness character,

1. Untrammeled. Wilderness is essentially unhindered and free from modern human control or manipulation.
2. Naturalness. Wilderness ecological systems are substantially free from the effects of modern civilization.
3. Undeveloped. Wilderness is essentially without permanent improvements or modern human occupation.
4. Outstanding opportunities for solitude or a primitive and unconfined type of recreation. Wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge.

A minimum requirement analysis is used to analyze impacts to these qualities of wilderness character from management actions. Approval of the use of prescribed fire in Wilderness is made by the Regional Forester. The minimum requirements analysis is documented in the Minimum Requirements Decision Guide in the process record.

The draft Wilderness Fire Management Plan contains more detailed descriptions of each Wilderness. The fire management plan is posted on-line as part of the process record.

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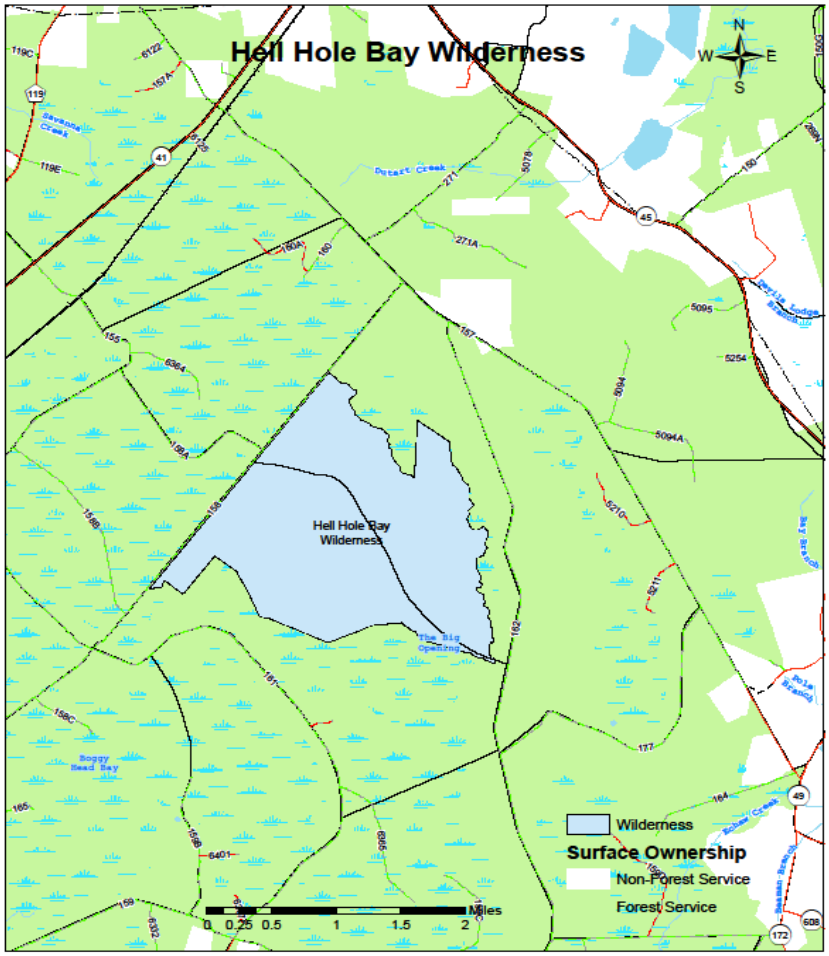
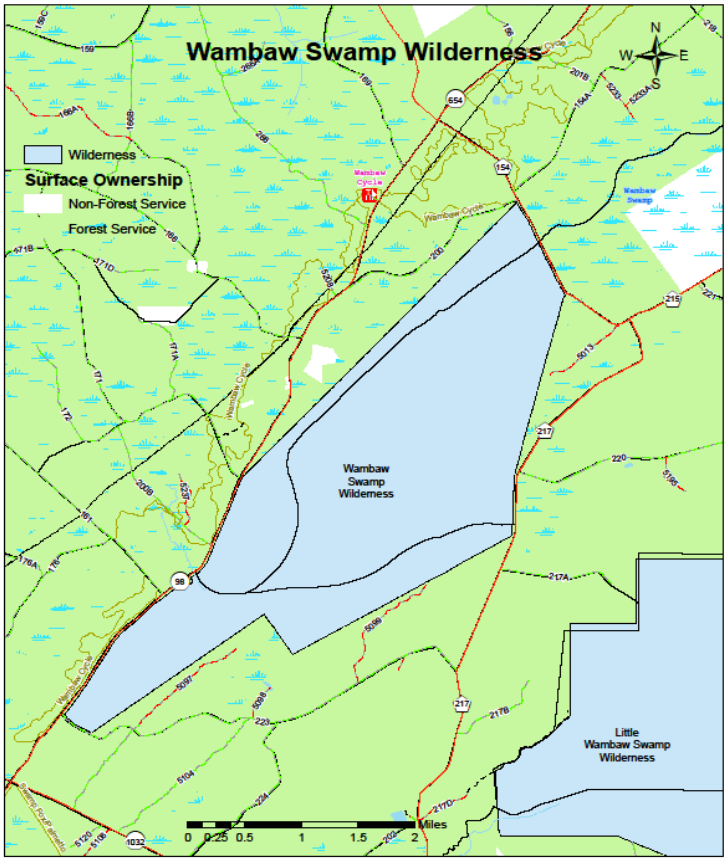


Hellhole Bay Wilderness (2,125 ac)

Fire History: Historically prescribed fire is used outside of this wilderness and allowed to back in and work a natural path into the wilderness. Prescribed fire has historically been used as a tool to reduce the heavy fuels surrounding the wilderness and in normal years these fires have extinguished once they reach the wet stands of the wilderness.

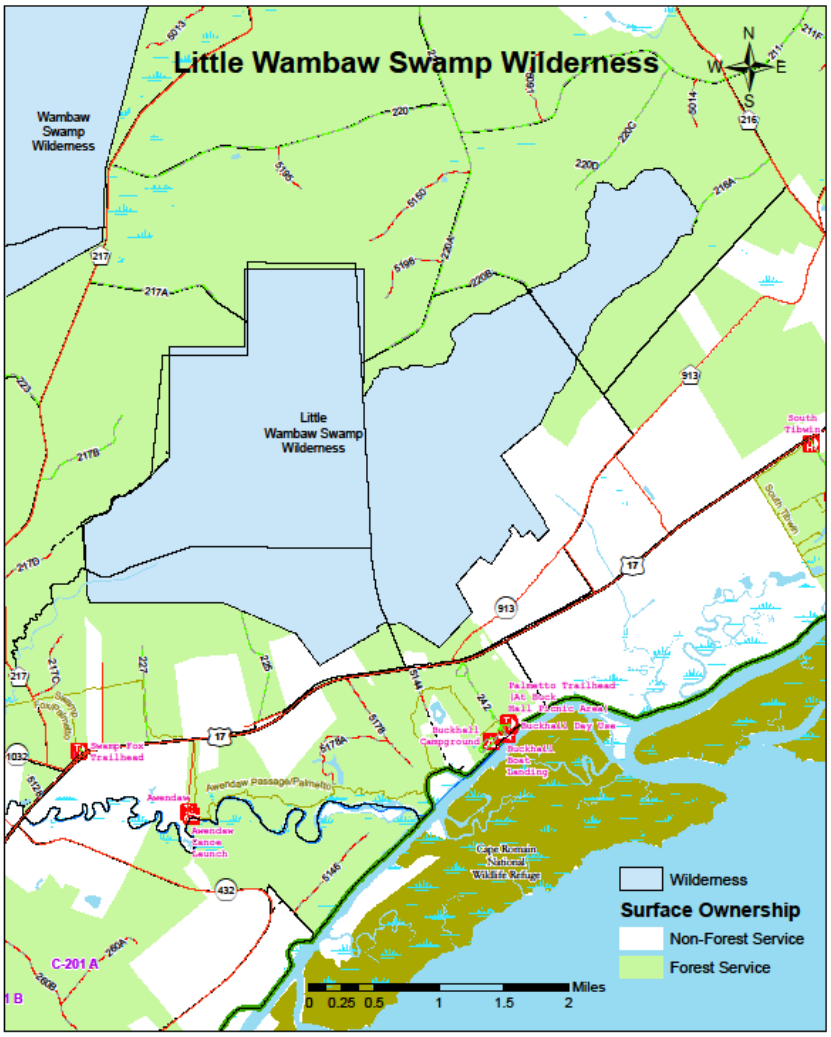
Human Health and Safety: Hellhole Bay Wilderness is nearest the communities at risk of Jamestown (approximately 2.5 miles) and Shulerville (approximately 2 miles). If natural ignition occurs during drought conditions in the heavy fuels of this wilderness, fire and smoke production may last several months and the impacts to the local communities will be long term in duration. Consideration for reducing fuel buildup should be taken if prolonged drought conditions become common and the wet stands that would normally prevent fire from progressing are depleted.



Wambaw Swamp (4,815 acres)

Fire History: In 2006, the regional forester approved the use of a helicopter for conducting aerial ignition and burn reconnaissance for this wilderness. Aerial ignition would ignite about 500 acres on a two to three year fire return interval in Compartment 186. Historically, prescribed fire is used outside of this wilderness and allowed to back in and work a natural path into the wilderness. Prescribed burning has historically been used as a tool to reduce the heavy fuels surrounding the wilderness and in normal years these fires have extinguished once they reach the wet stands of the wilderness.

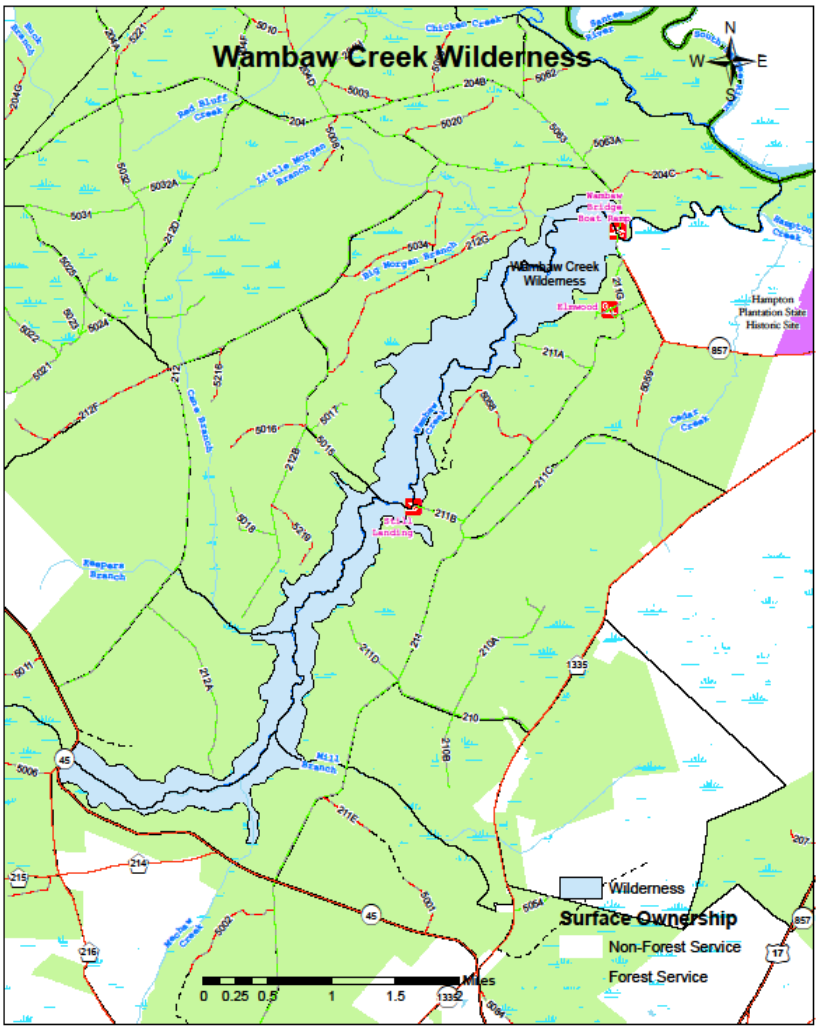
Human Health and Safety: Approximately three miles of the Wambaw Swamp Wilderness is adjacent to Halfway Creek road, a paved two-lane road that connects the communities of Honey Hill, Shulerville and Jamestown with the greater Charleston area. A small 32-acre inholding of private land neighbors the wilderness on the West side in between Halfway Creek road and the wilderness boundary consisting of established residents with multiple parcels and ownerships.



Little Wambaw Swamp (5,047 acres)

Fire History: With private land adjacent to much of this wilderness, human caused ignitions are more common in this wilderness than the other three on the forest. Future growth in the urban interface may increase human ignitions. Prescribed fire has historically been used as a tool to reduce the heavy fuels surrounding the wilderness and in normal years these fires have extinguished once they reach the wet stands of the wilderness.

Human Health and Safety: The southern point of Little Wambaw Swamp is within 0.10 mile of State Highway 17, a major traffic corridor between Charleston and Myrtle Beach. There are also two spans of boundary along the South (.64 miles) and Southeast (2.5 miles) that directly border private lands between parcels. Adjacently there are close to two dozen separate private parcels that border the wilderness with some containing residential structures. Due to the lack of National Forest System (NFS) land adjacent to the private parcels along the Southern section of this wilderness, hand ignition along these property boundaries is needed to ensure wildfires don't encroach into private property and threaten structures during a wildfire.



Wambaw Creek (1,825 acres)

Fire History: Prescribed fire may be used outside of this wilderness and allowed to back in and work a natural path into the wilderness. Prescribed fire has historically been used as a tool to reduce the fuels surrounding the wilderness and in normal years these fires have extinguished once they reach the wet stands of the wilderness.

Effects

A minimum requirements analysis was completed for each Wilderness that concluded minimal impacts to wilderness character are anticipated with the spread of prescribed fire, allowing lightning strikes to burn and the ignition of prescribed fire. Since no heavy equipment would be used within the Wildernesses, the effects would not be noticeable from a naturally-ignited wildfire. The fire management plan describes when the fire from lightning strikes in or near wildernesses would be allowed to burn.

Lightning-ignited fires, if allowed to burn as proposed in the proposed action and modified proposed action, may benefit some the naturalness and untrammeled character of wilderness by opening up the forest, reducing fuel loading to acceptable levels and maintaining the vegetation. There would be a short-term negative impact to air quality, visual aesthetics and possibly water quality.

In the modified proposed action and current management alternatives, management-ignited prescribed fires that mimic the role of natural fire can benefit fire-dependent ecosystems and the naturalness of the area as well as the untrammeled character. Reducing hazardous fuels can impact the wilderness characters through impacts to wilderness visitors and experiences, water quality and habitat within wilderness. At the same time, it can benefit wilderness by reducing fuel loadings to acceptable levels such that naturally ignited fires may be returned to the wilderness or wilderness study area. Ignition of prescribed fire reduces the potential effects of wildfire. No permanent structures are needed and no ground-based equipment would be used so impacts to the untrammeled quality of wilderness character would not be noticeably different from a naturally ignited wildfire.

Indirect effects on wilderness character under all three alternatives include decreasing the risk of damaging wildfire to the Wildernesses, adjacent areas or resources outside the wilderness boundary. Lingering effects of charred trunks and burnt trees may affect visitor's experiences. However, seeing fire play its natural role in the ecosystem allows visitors to feel they are a part of the natural environment. As the wilderness becomes more open and visibility increase due to periodic burning, opportunities for recreational activities will increase, such as orienteering, bird watching, and other wildlife viewing. The more open views can however increase people's ability to see others and this can decrease solitude as it is easier to see through the area.

Cumulative Impacts

Timber harvesting and many other activities are not allowed within Wildernesses, so no cumulative impacts to wilderness character are anticipated because of the limited activity within these areas.

Activities on other ownership are outside the control of the Forest Service. Environmental effects that could impact the integrity of the natural systems in wilderness include air pollution from outside sources and threats to native plant species from the spread of noxious weeds from sources outside wilderness. A general trend on private lands surrounding the Francis Marion National Forest is the gradual loss of preferred settings for nature-based recreation as well the potential to access private lands. These trends should not affect the wilderness character.

Agencies or Persons Consulted

The Forest Service consulted the following individuals, Federal, State, tribal, and local agencies during the development of this EA:

US Fish and Wildlife Service, Charleston Field Office.

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Appendix A - Alternative 2 (Current Management)

Table A-1. Current Management Prescribed Fire Units

Burn Unit*	Burn Acres	Mile of dozer line to construct	Miles of dozer line to refurbish	# of RCW clusters within ½ mile of the burn unit**
6	500	2.5	0	2
9	1000	1.5	0	0
10	1500	2.5	0	1
13	454	1.5	0	1
15	928	1.5	0	0
16	1229	0	2	6
17A	777	0	1	5
17B	367	0	1	2
18	1375	0	1.5	9
19	867	1.5	0	1
20	1514	2.0	0	2
31	633	1.5	0	0
32	655	1.1	0	3
34	100	0.5	0	1
35	634	2.5	0	2
36	250	2.0	0	3
37	636	0	2	5
38	736	0	1.5	6
39	279	2.5	0	2
40	1365	4.5	0	6
41,42	752	0	0.5	7
43	732	0	0	4
44	433	0	0	1
45/46	929	0	0.4	6
46/63/64	1395	0	0.3	3
47	828	0	0	7
48	350	0	.2	3
53	1066	0	0.7	1
57	726	0	0.4	2
58	667	0	2	5
59	225	0	2	2
62	483	0	0	4
62/63	581	0	0.5	6
63/70	404	0	0.5	4
65/66	1088	0	0	2
67/68	610	0	0	5
69	954	1.5	0	6
70	688	0	0	1
71	519	0	0.3	12
72	344	0	0.8	18
73/79	1311	0	0	20
74	722	0	0	12
75/76/78	2360	0	0	16
80	389	0	0.1	16

Burn Unit*	Burn Acres	Mile of dozer line to construct	Miles of dozer line to refurbish	# of RCW clusters within ½ mile of the burn unit**
81	**409**	**0**	**0**	**3**
82	**778**	**0**	**0**	**7**
83	**1025**	**0**	**1.5**	**9**
84	**1276**	**0**	**0**	**7**
85A	**828**	**0**	**0.2**	**4**
85B	**420**	**0**	**0**	**4**
85C	**600**	**2.5**	**0**	**3**
86	**359**	**3.0**	**0**	**3**
87/88	**1144**	**0**	**1.1**	**17**
89	**913**	**0**	**2.4**	**9**
90	**172**	**3.5**	**0**	**4**
92	**200**	**0**	**0**	**1**
93	**1104**	**0**	**1.5**	**2**
94	**368**	**0**	**0.1**	**9**
95	**1517**	**0**	**0.7**	**9**
96/185	**1472**	**0**	**0**	**14**
97	**1603**	**0**	**0.1**	**5**
100/101	**1588**	**0**	**0**	**5**
103	**500**	**1**	**0**	**4**
104	**500**	**1.5**	**0**	**2**
105	**700**	**3.5**	**0**	**3**
107/111	**1554**	**0**	**3**	**20**
108	**678**	**0**	**2.6**	**9**
109	**514**	**0**	**1.3**	**11**
110	**474**	**0**	**2**	**12**
112	**479**	**0**	**0.5**	**7**
113	**586**	**0**	**3.5**	**7**
114	**964**	**0**	**2.1**	**12**
115/116	**1040**	**0**	**0.5**	**12**
115/116A	**444**	**1**	**0**	**6**
118	**234**	**1**	**0**	**5**
120/121	**1147**	**0**	**0**	**3**
122A	**622**	**0**	**1.5**	**5**
122B,C	**1902**	**0**	**1.5**	**11**
123/139	**1511**	**0**	**0**	**15**
124	**867**	**0**	**1.5**	**8**
125	**758**	**0**	**0**	**6**
126/128	**1783**	**0**	**0**	**12**
130	**1016**	**0**	**2.6**	**8**
131	**628**	**0**	**0**	**6**
132	**1209**	**0**	**0**	**9**
133	**1286**	**0**	**0.5**	**15**
134	**901**	**0**	**2.9**	**10**
135	**523**	**0**	**1.5**	**3**
136	**283**	**0**	**0.5**	**3**
136/137	**1044**	**0**	**2.5**	**9**
138	**818**	**0**	**0.2**	**12**
140	**983**	**0**	**2**	**13**
141	**1500**	**4.5**	**0**	**5**

Burn Unit*	Burn Acres	Mile of dozer line to construct	Miles of dozer line to refurbish	# of RCW clusters within ½ mile of the burn unit**
142	**2000**	**1.0**	**0**	**3**
143	**200**	**1.0**	**0**	**5**
147	**674**	**3.0**	**0**	**2**
148	**845**	**0**	**1.5**	**13**
149	**1292**	**0**	**0**	**13**
150	**662**	**0**	**0**	**7**
151	**1384**	**0**	**1.5**	**17**
152	**262**	**0**	**3.5**	**9**
153	**654**	**0**	**3**	**7**
154	**997**	**6.5**	**0**	**7**
155	**424**	**0**	**3.5**	**5**
156	**548**	**0**	**1.3**	**13**
157/158	**849**	**0**	**0**	**10**
159	**963**	**0**	**0**	**6**
160	**1060**	**0**	**0.2**	**2**
161A	**322**	**0**	**0.1**	**2**
161B	**630**	**0**	**2.2**	**7**
162	**916**	**0**	**0.7**	**5**
163	**543**	**0**	**0.2**	**1**
164	**577**	**0**	**0**	**6**
165	**649**	**0**	**0.5**	**4**
166	**894**	**0**	**0.5**	**7**
167	**701**	**0**	**0.1**	**4**
168	**1083**	**0**	**1.5**	**10**
169	**795**	**0**	**2.5**	**5**
170	**839**	**0**	**0.1**	**5**
170A	**364**	**0**	**1**	**2**
171/188	**1273**	**0**	**1.5**	**13**
172	**316**	**0**	**0**	**3**
173	**539**	**0**	**0.7**	**1**
174	**485**	**0**	**0**	**2**
175	**1838**	**0**	**0.2**	**10**
176	**959**	**0**	**0.5**	**6**
177	**842**	**0**	**2.5**	**3**
178	**838**	**0**	**1.5**	**5**
179/181	**1230**	**0**	**0.5**	**9**
180/184	**1531**	**0**	**0**	**14**
182/183	**2081**	**0**	**0.6**	**25**
186W	**278**	**0**	**0**	**7**
186/194/195	**2150**	**0**	**0**	**11**
187	**546**	**0**	**1.7**	**7**
187/188	**657**	**0**	**0**	**6**
191	**1000**	**3.5**	**0**	**1**
192	**1727**	**2.0**	**1.5**	**2**
193	**109**	**0**	**0**	**1**
196	**1102**	**0**	**0.1**	**9**
197/198	**1069**	**0**	**0**	**6**
204/208	**575**	**0**	**0.2**	**3**
205A	**484**	**0**	**2**	**8**

Burn Unit*	Burn Acres	Mile of dozer line to construct	Miles of dozer line to refurbish	# of RCW clusters within ½ mile of the burn unit**
205B	**163**	**0**	**0**	**4**
206	**431**	**0**	**1.5**	**9**
207	**481**	**2.5**	**0**	**2**
214	**332**	**3.5**	**0**	**4**
216	**90**	**0**	**0.5**	**2**

*** Only the portion of the mapped burn unit suitable for burning is included as burn acres**
**** Suitable habitat within a ½ mile of a cluster center is counted as foraging habitat according to the RCW Recovery Plan (USFWS 2003). A cluster is an aggregate of active and inactive cavity trees.**

Appendix B - Alternative 1 (Proposed Action)

Table B-1. Acres of burn area by management area and compartment on the Francis Marion

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
Management Area 1	152,596	3,578	156,174
0006	0	0	0
0007	0	0	0
0016	0	0	0
0017	702	0	702
0018	1,528	0	1,528
0019	371	0	371
0020	1,739	0	1,739
0030		0	0
0035	661	0	661
0036	910	0	910
0037	700	0	700
0040	0	0	0
0041	943	0	943
0042	1,548	0	1,548
0043	638	0	638
0044	1,676	0	1,676
0045	705	0	705
0046	1,023	0	1,023
0047	1,011	0	1,011
0048	797	0	797
0049	0	0	0
0052	0	10	10
0053	1,267	0	1,267
0054	0	0	0
0057	978	0	978
0058	1,171	0	1,171
0060	0	0	0
0061	0	0	0
0062	595	0	595
0063	292	0	292
0064	2,404	0	2,404
0065	1,570	59	1,629
0066	2,076	0	2,076
0067	1,391	0	1,391

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0068	2,440	0	2,440
0069	846	0	846
0070	79	0	79
0071	818	0	818
0072	692	0	692
0073	504	0	504
0074	1,023	0	1,023
0075	930	0	930
0076	910	0	910
0077	0	0	0
0078	731	0	731
0079	1,132	0	1,132
0080	1,147	0	1,147
0081	670	0	670
0082	1,231	0	1,231
0083	2,497	0	2,497
0084	1,643	0	1,643
0085 (includes Santee Experimental Forest)	1,735	0	1,735
0086	0	0	0
0087	517	0	517
0088	743	0	743
0089	1,208	0	1,208
0090	0	0	0
0091	0	0	0
0092	0	0	0
0093	1,255	0	1,255
0094	415	0	415
0095	2,053	0	2,053
0096	1,217	0	1,217
0097	2,242	0	2,242
0098	0	0	0
0099	0	0	0
0100	722	0	722
0101	1,179	0	1,179
0102	0	0	0
0107	1,571	0	1,571
0108	991	0	991
0110	504	0	504

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0111	1,295	0	1,295
0112	1,254	0	1,254
0113	775	0	775
0114	1,217	0	1,217
0115	265	1	267
0116	1,013	0	1,013
0117	0	0	0
0119	0	0	0
0120	346	0	346
0121	1,567	0	1,567
0122	2,624	0	2,624
0123	909	0	909
0124	839	0	839
0125	1,121	0	1,121
0126	1,253	0	1,253
0127	0	6	6
0128	1,359	0	1,359
0129	0	0	0
0130	988	0	988
0131	779	423	1,202
0132	1,395	540	1,935
0133	1,662	0	1,662
0134	1,357	0	1,357
0135	757	0	757
0136	638	0	638
0137	936	0	936
0138	822	0	822
0139	1,007	0	1,007
0140	991	0	991
0141	2,189	0	2,189
0142	2,268	0	2,268
0144	0	0	0
0145	0	0	0
0146	0	0	0
0147	1,186	0	1,186
0148	1,317	1	1,318
0149	1,470	166	1,636
0150	722	241	963
0151	1,430	0	1,430
0152	707	0	707

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0153	787	0	787
0154	1,655	0	1,655
0155	0	0	0
0156	686	0	686
0157	785	0	785
0158	422	194	616
0159	1,065	268	1,333
0160	1,327	0	1,327
0161	1,233	0	1,233
0162	1,187	0	1,187
0163	856	0	856
0164	563	0	563
0165	870	0	870
0166	1,773	0	1,773
0167	836	0	836
0168	1,414	0	1,414
0169	866	0	866
0170	2,005	503	2,508
0171	1,548	0	1,548
0172	421	0	421
0173	552	0	552
0174	669	0	669
0175	3,406	0	3,406
0176	1,527	0	1,527
0177	1,094	0	1,094
0178	1,024	0	1,024
0179	635	0	635
0180	1,265	0	1,265
0181	1,252	0	1,252
0182	1,981	0	1,981
0183	1,093	0	1,093
0184	1,138	0	1,138
0185	1,451	0	1,451
0186	1,363	1,151	2,514
0187	1,003	0	1,003
0188	2,041	1	2,042
0189	0	0	0
0192	86	0	86
0193	0	0	0
0194	1,905	0	1,905

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0195	1,295	0	1,295
0196	1,973	0	1,973
0197	1,568	0	1,568
0198	473	0	473
0203	0	0	0
0204	817	0	817
0205	1,342	0	1,342
0206	543	0	543
0208	0	0	0
0217	114	0	114
Management Area 2	30,519	71,793	102,312
0001		346	346
0002		595	595
0003		1,193	1,193
0004		1,169	1,169
0006	628		628
0007	377	0	377
0008	259	1362	1,621
0009	2,020		2,020
0010	2,036		2,036
0013	527		527
0014		868	868
0015	1,197	0	1,197
0016	1,679	0	1,679
0017	403	0	403
0018	0	0	0
0019	646	0	646
0020	1,739	0	1,739
0021	0	316	316
0022	0	941	941
0025	0	1,350	1,350
0026	0	714	714
0027	0	804	804
0028	0	466	466
0029	0	904	904
0030	0	341	341
0031	0	639	639
0032	0	826	826
0033	0	1,429	1,429
0034	0	1,495	1,495

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0036	82	0	82
0038	1,180	0	1,180
0039	0	289	289
0040	1,340	0	1,340
0041	0	0	0
0042	0	0	0
0043	286	1,025	1,311
0047	0	0	0
0049	0	2,244	2,244
0050	0	2,254	2,254
0051	0	1,877	1,877
0052	0	1,031	1,031
0053	0	0	0
0054	0	1,386	1,386
0055	0	235	235
0057	0	0	0
0059	0	741	741
0060	0	559	559
0061	0	526	526
0062	420	0	420
0063	681	0	681
0064	0	0	0
0065	11	1,037	1,048
0069	458	0	458
0070	1,639	0	1,639
0071	142	0	142
0072	821	0	821
0077	0	252	252
0081	0	0	0
0085 (includes Santee Experimental Forest)	2,445	0	2,445 (Total 3,180 acres with 1,735 acres in MA1 for the Santee Experimental Forest)
0086	0	1,074	1,074
0087	87	514	601
0088	0	0	0
0090	0	370	370
0091	0	766	766
0092	0	557	557

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0093	180	0	180
0094	224	0	224
0098	0	852	852
0099	0	884	884
0102	0	515	515
0103	596	0	596
0104	710	0	710
0105	793	0	793
0106	0	120	120
0109	794	0	794
0110	102	0	102
0115	2	772	774
0116	109	0	109
0117	0	2,572	2,572
0118	0	592	592
0119	0	1,553	1,553
0121	195	0	195
0124	258	0	258
0126	314	0	314
0127	0	831	831
0136	0	0	0
0137	54	0	54
0140	22	0	22
0141	405	0	405
0142	0	0	0
0143	1,264	0	1,264
0144	0	2,106	2,106
0145	0	123	123
0146	47	1,090	1,137
0148	0	34	34
0152	60	0	60
0155	850	0	850
0157	72	0	72
0158	0	0	0
0160	0	0	0
0162	0	0	0
0163	354	0	354
0164	636	0	636
0165	36	0	36
0166	210	0	210

Compartment	Existing Burn Area (acres)	New Burn Area (acres)	Grand Total (acres)
0167	222	0	222
0169	87	0	87
0170	0	0	0
0172	7	2,769	2,776
0173	77	833	911
0187	325	0	325
0189	0	2,095	2,095
0190	0	2,041	2,041
0191	1,096	0	1,096
0192	992	718	1,710
0193	653	0	653
0196	0	0	0
0198	489	0	489
0199	0	666	666
0200	0	328	328
0201	0	1,652	1,652
0202	0	1,018	1,018
0203	0	1,083	1,083
0204	0	0	0
0207	0	836	836
0208	0	811	811
0209	0	819	819
0210	0	1,263	1,263
0211	0	544	544
0212	0	793	793
0213	0	1,130	1,130
0214	0	1,349	1,349
0215	0	1,044	1,044
0216	0	512	512
0217	0	1,150	1,150
0218	0	963	963
0219	0	1,696	1,696
Grand Total	183,115	75,371	258,487

Appendix C - Region 8 Smoke Management Guidelines

USDA FOREST SERVICE REGION 8
SMOKE MANAGEMENT GUIDELINES
September 1, 2010

SMOKE MANAGEMENT OBJECTIVES:

Ensure the burn plan is prepared and the burn is executed to meet all of the following:

- Minimize the amount and concentration of smoke entering populated areas
- Prevent / minimize public health and safety hazards, including
  - Impacts to sensitive sites (schools, hospitals, nursing homes, etc.)
  - Visual impairment on highways, airports, etc.; both day and night
- Avoid exceedances of National Ambient Air Quality Standards (NAAQS)
- Protect visibility in Class I areas

MEETING USDA FOREST SERVICE POLICY

The burn plan shall be prepared to ensure the smoke management objectives meet agency policy that prescribed fires will not contribute to or cause an exceedance of a National Ambient Air Quality Standard (NAAQS). Burn planning will include the appropriate analysis procedures to evaluate downwind smoke concentrations to ensure protection of public health and safety.

SMOKE DISPERSION EVALUATION

Step 1: For all prescribed burns, check the Current and Forecast AQI at the following site: http://www.airnow.gov/. Do not burn under a wind direction that would transport smoke into an area that is forecast to be at the AQI code orange, red, or purple on the day or evening of the burn.

Step 2: Fully comply with the mandatory or voluntary State Smoke Management Program (SMP) or guidelines.

A. The following states have written programs or guidelines that provide guidance for evaluating smoke dispersion. National Forests within the following states will complete the smoke management requirements listed in those state smoke management programs and guidelines. The agency administrator may determine that smoke dispersion assessment beyond what is required by the States is necessary to fulfill agency policy and may elect also to utilize **Steps 3 through 9**:

a. Alabama
b. Arkansas
c. Georgia
d. Florida
e. Louisiana
f. Mississippi
g. South Carolina
h. North Carolina
i. Virginia

B. The states listed here do not have written programs or guidelines that specify detailed procedures for assessing downwind impacts to smoke sensitive areas. National Forests within these states will complete the smoke management requirements described in **Steps 3 through 9** below:

c. Kentucky b. Oklahoma c. Tennessee d. Texas

Step 3: Estimate downwind smoke concentrations and movement of residual smoke. Methodology shall be commensurate with the risk associated with potential downwind smoke impacts.

A. A simple smoke screening (**Figure 1)** can be used **<u>if all</u>** of the following criteria are met for the planned prescribed burn:
   a. Four tons of fuel (or less) are consumed per acre,
   b. 180 acres per hour (or less) are in the active fire phase,
   c. Opaque cloud cover is less than 60 percent,
   d. Background concentration of particulate matter unit is 20 micrograms per cubic meter (or less).
   e. Meets the minimum meteorological criteria in Table 1

B. If the prescribed burn does not meet all of the criteria in "a" – "e" above, then a dispersion model will need to be run for the burn to that modeled downwind smoke concentrations are within acceptable limits to achieve the smoke management objectives listed at the beginning of these guidelines. Available models for completing this analysis include VSMOKE, VSMOKE-GIS (used during burn planning), and HYSPLIT-PC (used within 48 hours of burning to assist go-no-go decision).

Table 1. Minimum combinations for transport winds speeds and mixing heights (above ground level). *(Use these minimums if the burn meets the criteria listed in "A" above).*

<u>Transport Wind Speed</u>		<u>Mixing Height Minimum</u>		<u>Minimums Rounded to Nearest</u>	
Meters per second	Miles per hour	Meters	Feet	Miles per hour	Feet
3.0	6.7	890	2920	7	2700
3.1	6.9	850	2789		
3.2	7.2	800	2625		
3.3	7.4	770	2526		
3.4	7.6	740	2428	8	2300
3.5	7.8	720	2362		
3.6	8.1	690	2264		
3.7	8.3	660	2165		
3.8	8.5	640	2100	9	1900

Transport Wind Speed		Mixing Height Minimum		Minimums Rounded to Nearest	
3.9	8.7	620	2034		
4.0	8.9	600	1968		

- Do not burn when the minimum combination of mixing heights (above ground level) and transport wind speeds are below the values shown in Table 1, unless atmospheric dispersion modeling results clearly demonstrate no smoke sensitive targets are likely to be adversely impacted.

- If the mixing height is typically reported by the National Weather Service (NWS) as above sea level (ASL), then use ArcGIS to calculate the weighted average elevation for the entire burn unit. This value is then subtracted from the mixing height value desired or reported by the NWS. The objective is to get mixing heights estimated at "above ground level."

- Variances on these regional minimum meteorological combinations will only be considered when dispersion modeling shows the smoke will be adequately dispersed so downwind sensitive areas will not be unacceptably impacted by smoke.

Figure 1. Simple Smoke Screening to estimate the direction and area of daytime smoke dispersal.

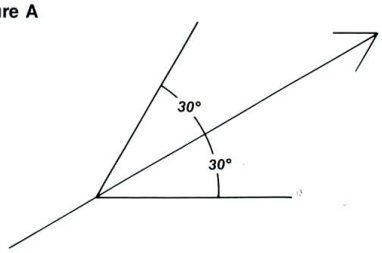
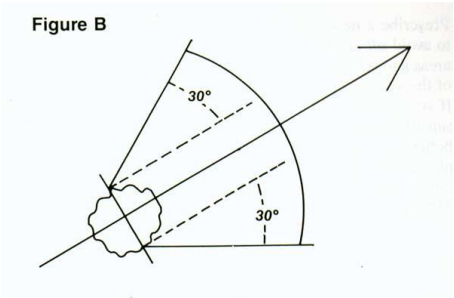
This screening can be completed by hand (refer to Figure 1) or on the computer at the internet site: http://shrmc.ggy.uga.edu/maps/screen.html.

A. Use maps on which the locations of smoke-sensitive areas can be identified. Plot the anticipated downwind smoke movement at a distance of *X* based on fuel consumption:

Consumption (tons per acre)	**Distance**
<= 0.5	330 feet
0.51 - 1.0	0.5 miles
1.1 - 2.0	4 miles
2.1 – 3.0	12 miles
3.1 – 4.0	25 miles

First locate the planned burn area on a map and draw a line representing the centerline of the path of the smoke plume (direction of transport wind) for the distance indicated. **If the burn will last 3 or more hours, draw another line showing predicted wind direction at completion of the burn**

B. To allow for horizontal dispersion of smoke as well as shifts in wind direction, draw two other lines from the fire at an angle

of 30 degrees from the centerlines of forecasted wind direction will be used. If fire is represented as a spot, draw as in figure A and if larger, draw as in figure B. The result is your probable daytime smoke impact area.	Figure A  Figure B 

Step 4: Locate all known smoke sensitive targets within or immediately adjacent to the area of potential downwind smoke impacts utilizing a geographic information system (GIS), or on a master map. Examples may include, but are not limited to, areas with existing air pollution or visibility problems, non-attainment areas, airports, communities, schools, highways, hospitals, any area monitored by the state air regulators, and metropolitan/urban areas. Smoke sensitive targets also include Class I areas, where visibility is protected by the Clean Air Act (Table 2.).

Table 2. Listing of Class I areas in Region 8.

STATE	CLASS I AREA	ACRES
ALABAMA	Sipsey Wilderness (USFS)	24,922
ARKANSAS	Caney Creek Wilderness (USFS)	14,460
	Upper Buffalo Wilderness (USFS)	12,035
FLORIDA	Everglades National Park (NPS)	1,506,499
	Chassahowitzka Wildlife Refuge	23,580
	(FWS) St. Marks Wildlife Refuge	17,350
	(FWS)	24,602
	Bradwell Bay Wilderness (USFS)	

GEORGIA	Cohutta Wilderness (USFS) Okefenokee Wildlife Refuge (FWS) Wolf Island Wildlife Refuge (FWS)	36,977 353,981 5,126
KENTUCKY	Mammoth Cave National Park (NPS)	52,707
LOUISIANA	Breton Wildlife Refuge (FWS)	5,000
NORTH CAROLINA	Linville Gorge Wilderness (USFS) Shining Rock Wilderness (USFS) Swanquarter Wildlife Refuge (FWS)	21,002 16,133 8,785
SOUTH CAROLINA	Cape Romain Wildlife Refuge (FWS)	29,000
TENNESSEE/NORTH CAROLINA	Great Smokey Mountain National Park (NPS) Joyce Kilmer- Slickrock Wilderness (USFS)	520,269 17,394
TEXAS	Big Bend National Park (NPS) Guadalupe Mountains National Park (NPS)	801,163 46,850
VIRGINIA	Shenandoah National Park (NPS) James River Face Wilderness (USFS)	79,579 8,903
VIRGIN ISLANDS	Virgin Islands National Park (NPS)	14,689

Step 5: Determine what adjustments or mitigations are necessary to achieve the Smoke Management Objectives. Techniques for reducing emissions from burns can be reviewed in Smoke Management Guide for Prescribed and Wildland Fire – 2001 Edition (National Wildfire Coordination Group, NFES-1279/PMS 420-2). A few examples of mitigation are listed in Table 3 below.

Table 3. Examples/Techniques of Mitigation for Consideration

1. Contact people known to be sensitive to air pollution prior to the ignition of the prescribed fire if they could be impacted by smoke. This could include hospitals, nursing homes, isolated residences, etc. News releases in newspapers and by radio or TV may be appropriate.
2. Notify public safety agencies such as State Highway Patrol, County Sheriff, Local Law Enforcement, Highway Departments, and 911 Dispatch centers. State Forestry and Air Quality offices should also be included.
3. Post smoke-warning signs to warn the public of areas where smoke may create a hazard to driving. All warning signs used must meet standards as described in FSH 7109.11 Sign Handbook. Patrol potentially affected areas (especially at night and during early morning hours) to ensure residual smoke is not causing safety concerns.